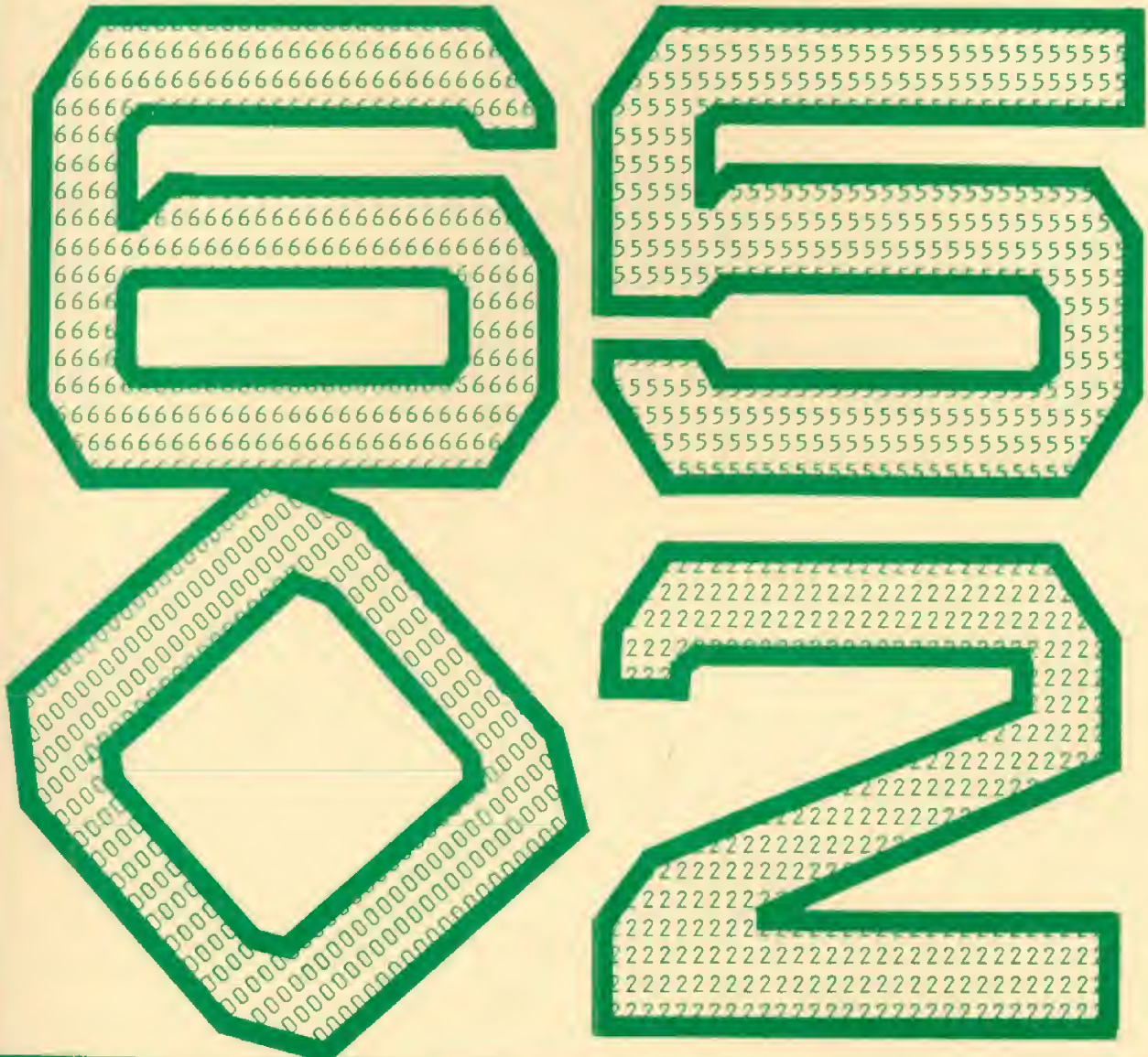


MICROTM

The Magazine of the **APPLE, KIM, PET**
and Other **6502** Systems



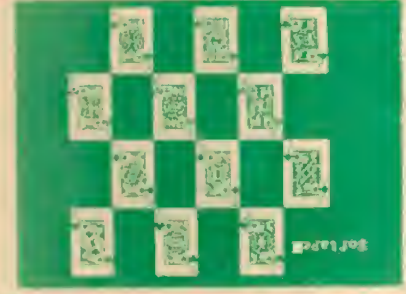
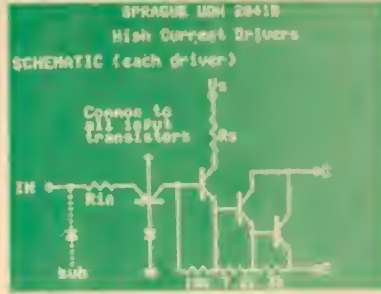
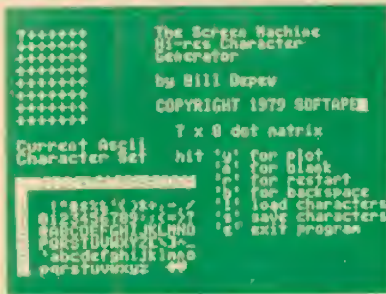
NO 12

May

1979

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APPLE HI-RES GRAPHICS: The Screen Machine by Softape



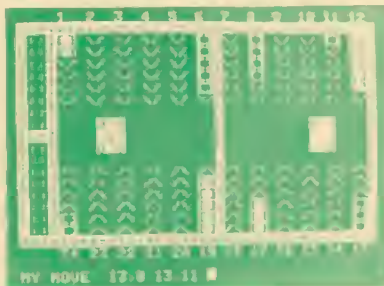
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MAY 1979

ISSUE NUMBER TWELVE

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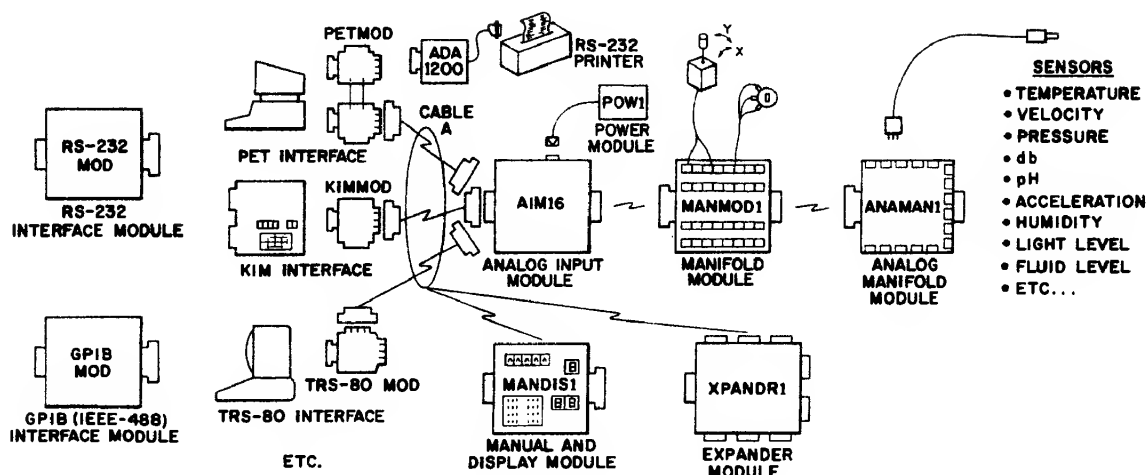
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POW1 - Power Module Supplies power for one AIM16 module.	\$14.95
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SENSORS Sensors for temperature, pressure, flow, humidity, level, pH, motion, etc.	TBA
COMPUTER INTERFACES For the PET, KIM, TRS-80, etc. Use in place of OCON. Eliminates the need for soldering or special construction.	TBA
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KIMMOD - KIM Interface Module Gives one application connector port and one DAM SYSTEMS interface port.	\$39.95
CABLE "A" - Interconnect Cables Connects computer interface to AIM16, MANDIS1, XPANDR1, etc.	TBA
CABLE A24 - Interconnect Cable 24 inch cable with interface connector on one end and an OCON equivalent on the other.	\$19.95
MANDIS1 - Manual and Display Module Connects between the AIM16 and the computer interface. Allows manual or computer control of the AIM16. Displays channel number and data.	TBA
GPIB MOD - GPIB (IEEE-488) Interface Allows the DAM SYSTEMS MODULES to be used with the GPIB bus instead of a computer's other I/O ports.	TBA
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AIM161 Starter Set Includes one AIM161, one POW1, one ICON and one OCON.	\$189.00
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PETSET1a Includes one PETMOD, one CABLE A24, one AIM161, one POW1 and one MANMOD1.	\$295.00
KIMSET1a Includes one KIMMOD, one CABLE A24, one AIM161, one POW1 and one MANMOD1.	\$285.00

**NEXT
IN THIS ISSUE**

While this space is usually used to discuss the contents of the current issue, I would like to use it this month to talk about the exciting new changes coming up in the June 1979 issue of MICRO. These changes reflect our continuing effort to make MICRO even better than before.

The most significant change is that MICRO will be increased in size from the current 52 pages up to 68 pages. This is due to the continuing growth of both the articles submitted for publication and the increased interest in advertising in MICRO. The 16 page expansion will support growth in both of these areas.

The second most important change is that MICRO is going to be printed by a more sophisticated printing method. It will be printed on glossy stock which make for easier-to-read text, permits far superior halftones, and is slightly lighter so that mailing costs will remain about the same even though the size has increased.

One objection I have had to the current format of MICRO, an objection that has also been voiced by others, is that while the articles are the important part of MICRO, the overall magazine is a bit heavy or dry. To overcome this, some of the new space will be used for news, informal discussions, points-of-view, and so forth. I do not plan to publish "love-letters", but if you have something to say that may not merit an entire article - then write a short note. We will make room for these less formal presentations.

The overall appearance of MICRO will be improved - from the two color cover to the interior layout. We have analysed a number of other magazines and tried to "lift" those features that made them interesting and readable. I know that there are some "purists" in the audience who will object to any changes in the magazine, but I feel that most readers will appreciate the improvements. Some of the current features that we will definitely maintain are: the three-hole punch, the organization of each article into contiguous pages generally unbroken by ads, the protective mailing cover, and, of course, the editorial direction toward useful features and articles over games and "blue-sky" speculation.

With the increase in size and production cost, there will be an increase in price - but not that much. The retail price will increase to \$2.00, but the subscription will only increase to \$1.25 or \$15.00 per year in the US. This is the first increase in price since we began 12 issues ago. Subscriptions will be accepted at the old rate until June 1, 1979 - so you may want to renew ahead (but only for one year).

MICROBES

EKIM or MAXI-KIM, MICRO 11:20

17D1 B0 AD BCS START should have been
17D1 B0 B4 BCS GETK

Robert A. Stein, Jr. reports that the table of memory size changes in "A CASSETTE OPERATING SYSTEM FOR THE APPLE II", MICRO 11:21 has some errors. The corrected table appears below:

If using CASSDS in other than a 16K machine change location \$0358 as follows:

1F-8K 2F-12K 3F-16K 4F-20K 5F-24K 7F-32K
8F-36K BF-48K

CLUB ANNOUNCEMENTS

APPLESEED

c/o The Computer Shop
6812 San Pedro
San Antonio, TX 78216

(No information was included on their current meeting dates, nor was there a phone number given. This info would make the announcement much more useful !!)

An attempt is being made to organize an Apple group in New Hampshire. If you are interested, please contact:

Steve Adams
Governor Weare Apts.
Bldg. 1, Apt. 2
Seabrook, NH 03874
603/474-2230

ACG of NJ 6502/6800 User Group

Lew Edwards reports that the group is very active. "Meetings on 4th Friday at Union County Technical Institute have all kinds of expanded KIM's, PET's, an Apple group as well as AIM's and SYM's starting to show up. It's a wonderful way for beginners to get help from others in solving problems, getting their systems up and running, etc. Has really been taking off the last 6-7 months."

ABACUS (Apple Bay Area Computer Users Society)

Hayward BYTE Shop
1122 B Street
Hayward, CA

David R. Wilkerson, Secretary writes: "We have an active membership of 40, and we have developed a club library of 200+ programs. Currently we are negotiating to trade libraries with several other clubs." For more info call:

Ed Avelar, President
415/583-2431

Northwest Suburban Apple II Users Group

"Serving Apple II users in the Northwest Suburban Chicago area, we provide a forum for the interchange of knowledge, problems and application of the Apple II computer. Meetings are held the first Saturday of each month at the Palatine, Illinois Park District facility."

For more information please contact:

Ken Rose
650 Pompano Lane
Palatine, IL 60067
312/359-6723

ATTENTION ALL 6502 CLUBS

MICRO will be happy to donate a free six month subscription to any legitimate 6502 oriented club or user group. There are only two requirements for this offer:

1. A copy of the club/group mailing list must be sent to MICRO. This both shows that you are a real club and lets MICRO send a flyer to your members describing our publication.
2. Regular notification of meetings and events must be provided for this column. This will help us inform more potential members about your organization.

***** AIM-65 *****

<u>P/N</u>		<u>Qty 1-9</u>
A65-1	AIM-65 w/1K RAM	\$375
A65-4	AIM-65 w/4K RAM	\$450
A65-A	Assembler ROM	\$85
A65-B	BASIC ROMS	\$100

ACCESSORIES

<u>P/N</u>		
PRS1	+5V at 5A, +24V at 2.5A +12V at 1A (does not fit inside ENC1)	\$95
PRS2	+5V at 5A, +24V at 1A (mounts inside ENC1)	50
ENC1	AIM-65 case w/space for PRS2 and MEB1	45
MEB1	Memory expansion bd w/8K RAM; 8K PROM sockets and programmer for 2716; 6522 I/O chip	245
MEB2	Memory expansion bd w/16K RAM populated w/2114's	325
	Unpopulated	125
VIB1	Video bd w/128 char, 128 user char, prog. up to 100 char/line, up to 4K RAM, light pen interface and ASCII kybd interface	245
	Thermal Paper Tape, 9/85' rolls	10

SYSTEMS

All AIM-65 systems are assembled and tested.

"A" series have the power supply external (PRS1).

"B" series have the power supply mounted inside (PRS2).

<u>P/N</u>		<u>"A"</u>	<u>"B"</u>
<u>"STARTER" SYSTEMS</u>			
S_65-1	A65-1 in ENC1	\$495	\$475
S_65-1B	Same Plus BASIC	595	575
S_65-4	A65-4 in ENC1	560	540
S_65-4B	Same Plus BASIC	660	640

<u>"EXPANDED" SYSTEMS</u>			
E_65-1	A65-1, ENC1, MEB1	\$730	\$710
E_65-1B	Same Plus BASIC	830	810
E_65-4	A65-4, ENC1, MEB1	795	775
E_65-4B	Same Plus BASIC	895	875

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AN AIM 65 USER'S NOTES

Joe Burnett
16492 E. Tennessee Avenue
Aurora, CO 80012

The AIM 65 Microcomputer, made by Rockwell, is one of the newest, most versatile home computers available today. At the time of this writing (January 1979), it sells for \$375. For this you get the complete computer, with a 20 character alphanumeric display, full size alphanumeric keyboard, a printer which uses inexpensive calculator type paper, 1K of RAM and 8K ROM-resident programming. Options include the ability to add 3K more memory, a 4K assembler, and an 8K Basic interpreter, all on-board, simply by purchasing them and plugging them in. An "application" connector and an "expansion" connector accept standard 44 pin edge connectors, and allow the control and I/O of two cassette units and a teletype, as well as off-board additional memory. On-board programming (ROM-resident) gives you the ability to display memory in either hex or mnemonic, alter memory, edit programming, turn the printer on and off, display registers, and enter any of the many resident subroutines. With cassette units connected, you can read or write to either one, and set up the AIM 65 to handle KIM-1 format (X1 or X3) or the AIM 65 format software. The AIM 65 will file and search cassette tapes, and the front panel alphanumeric display lets you know the status of the operation in progress as well as the block of data being read or written. Three keys on the keyboard (F1, F2, and F3) enable user defined functions through programmed jump instructions, and are a nice feature. Physically, the computer circuit board itself is ten inches deep by twelve inches wide, and the keyboard (which attaches through a supplied ribbon cable) is four inches deep by twelve inches wide. Included with the computer is a roll of paper for the printer, "feet" for the computer circuit board and the keyboard circuit, a User's Guide manual, an R6500 Programming manual, a System Hardware manual, a Programming Reference Card, an AIM 65 Summary Card, and a large schematic diagram, as well as the warranty card (don't forget to mail this in).

Software Compatibility

As with any new product, there are some problems. One is with the KIM-1 software. The KIM-1 is a very basic computer, and the AIM 65 is sophisticated by comparison. An example of the problem with the software is the KIM-1 "PLEASE" program. "PLEASE" loads data into memory locations which either are dedicated for use by the AIM 65, or are not present in the AIM 65. Consequently, although the AIM 65 can be initialized to accept KIM-1 programming, check the listing before you try to do it. It'll save you a lot of time and frustration. The AIM 65 User's Guide Manual includes a detailed memory map which you can use to determine (from a program listing) whether or not the program you're trying to load will in fact load as advertised.

Some Cassette Control Problems

A second problem is with the cassette unit control circuitry. There are actually two circuits in the AIM 65 for each cassette unit, and although Rockwell made an attempt to cover all eventualities, they didn't succeed. The first circuit makes use of an integrated circuit relay driver, which puts a low (ground) at the cassette

control output pin of the "application" connector when the computer toggles the cassette unit "on". The second circuit is a transistor switch which is biased on when the computer toggles the cassette unit "on". The problem arises in that not all cassette units use a positive supply voltage with the negative line common (connected to the cassette unit frame). General Electric, for example, typically connects the positive side of the battery (or AC adapter) to the cassette unit frame, and uses negative voltage for the motor and electronic circuitry. At first glance, this doesn't look like a problem; after all, you only need to supply a closure to the remote switch line, and the cassette unit will run, right? Well, not quite. If you connect your GE cassette unit to the relay driver output pin, and the computer control has the cassette unit toggled "off", the cassette unit won't shut off. This is because you've put a negative voltage (from the cassette unit) at a point which has a nearly equal positive voltage (from the AIM 65), and the result is close enough to zero volts that the cassette unit motor runs even though the computer indicated that an "off" condition exists. Okay, so what about the transistor switch? Figure 9-4 of the User's Guide manual shows how to connect the wires. And the cassette unit won't run. At this point you're most likely very annoyed and confused (I know I was). The reason that the computer won't control the cassette unit is that (1) figure 9-4 of the User's Guide Manual is in error; the positive voltage from the cassette unit battery should go to pin "F", and the motor line should go to pin "E", of the "application" connector; and (2) the transistor does not have the voltages necessary to make it work, even after the wires are properly connected. If you look at the schematic diagram, you'll see that the transistor switch in the computer gets its operating voltage from the circuit it's controlling. To make it work, the transistor must have the proper bias (voltage between base and emitter), and to get this a common ground must exist between the computer power supply and the cassette unit power supply. It would seem that all that would be necessary would be to connect the emitter of the transistor (pin "F" of the "application" connector) to ground. Now the cassette unit will run and stop in response to computer control—until you plug in the ear and/or mic lines. When you do this, and the transistor turns on, you create a short circuit across the battery (or AC adapter) of the cassette unit. The reason is that when you wired up the ear/mic lines, you connected one side to ground on the 44 pin edge connector, and now the current finds a path through the cassette electronic circuitry, and everything stops. Under normal conditions, the remote switch on the cassette unit microphone is isolated from everything, so no problem exists. When you make the return line to the remote switch and the ear/mic line return common, a short circuit occurs. So what do you do now? Simulate an isolated switch, similar to what the microphone has. A relay is the only way, if you're going to control the cassette unit with the computer. Since my AIM 65 is still in the warranty period, I have not modified it as I'd like to. However, once the warranty period expires, I'm going to install two relays on the circuit board and use the transistor switches to control them. Then it won't matter what kind of motor control the cassette unit uses; I'll have the isolated switch action required to control any cassette unit, regardless of the polarity of the voltages involved.

A Sample Program

At the time of this writing, neither the Assembler nor the BASIC interpreter is available from my distributor. This means that any programming I do has to be done using mnemonic codes. Although the documentation in the User's Guide is very good, the sample programs shown appear to have been produced with the use of an Assembler. An example is on pages 7-82 and 7-83. This program is intended to display and print an assembled message, but the information on how to prepare the message for storage in memory is absent. So, if you input this program you'll be "all dressed up with nowhere to go". The program shown below will allow you to input a message, and then retrieve it, all with the "bare bones" (1K RAM) AIM 65. How you use this is up to you. It could be just "for show", or you can modify it as desired and

include it in more complex routines involving user interaction with the computer. This program does feature single key access (user function key F1, F2, or F3). Key F1 allows you to write to memory; key F2 retrieves the entire message; and key F3 retrieves the message a line at a time, with the space bar being used to advance the display to the next line of the message. The maximum length of the message is 13½ lines. An asterisk is typed at the end of the message when it is written to memory, which takes the computer out of the loop in all of the modes.

I hope the information in this article helps you avoid some of the problems and frustrations I've experienced. Enjoy your AIM 65. I'm having a lot of fun with mine, and I'm still learning what it's capabilities are.

WRITE TO MEMORY PROGRAM JOE BURNETT WITH MODS BY MIKE ROWE APRIL 1979

0000 ORG \$0000

AIM SUBROUTINES

0000	CRCK	*	\$EA24	DUMP PRINT BUFFER
0000	CRLF	*	\$E9F0	CARRIAGE RETURN/LINE FEED
0000	INALL	*	\$E993	INPUT FROM ANY DEVICE
0000	OUTALL	*	\$E9BC	OUTPUT TO ANY DEVICE

ASCII CHARACTER

0000	SPACE	*	\$0020	SPACE CHARACTER
0000	ASTER	*	\$002A	ASTERISK CHARACTER

WRITE MESSAGE TO MEMORY

0000	20 F0 E9	WRITE	JSR	CRLF	CLEAR DISPLAY
0003	A0 00		LDYIM	\$00	INIT MEMORY POINTER
0005	A2 13	LINE	LDXIM	\$13	INIT CHARACTER COUNTER
0007	20 93 E9	INPUT	JSR	INALL	GET AN INPUT CHARACTER
000A	99 00 02		STAY	\$0200	STORE IN BUFFER
000D	C9 2A		CMPI	ASTER	TEST TERMINATOR
000F	F0 47		BEQ	EXIT	IF YES, THEN DONE
0011	C8		INY		BUMP POINTER
0012	CA		DEX		DECR CHARACTER COUNTER
0013	D0 F2		BNE	INPUT	IF NOT ZERO, GET MORE
0015	20 24 EA		JSR	CRCK	LINE FULL, SO PRINT IT
0018	4C 05 00		JMP	LINE	GET NEXT LINE

READ ENTIRE MESSAGE

001B	20 F0 E9	REM	JSR	CRLF	CLEAR DISPLAY
001E	A0 00		LDYIM	\$00	INIT MEMORY POINTER
0020	A2 13	RLINE	LDXIM	\$13	INIT CHARACTER COUNTER
0022	B9 00 02	RCHAR	LDAY	\$0200	GET CHARACTER FROM MEMORY
0025	C9 2A		CMPI	ASTER	TEST FOR TERMINATOR
0027	F0 2F		BEQ	EXIT	IF YES, THEN DONE
0029	20 BC E9		JSR	OUTALL	ELSE, DISPLAY CHARACTER
002C	C8		INY		BUMP MEMORY POINTER
002D	CA		DEX		DECR. CHARACTER COUNTER
002E	D0 F2		BNE	RCHAR	IF NOT ZERO, GET NEXT CHARACTER
0030	20 24 EA		JSR	CRCK	ELSE, PRINT LINE
0033	4C 20 00		JMP	RLINE	THEN CONTINUE

READ MESSAGE ONE LINE AT A TIME

```

0036 20 F0 E9  ONELIN JSR  CRLF  CLEAR DISPLAY
0039 A0 00      LDYIM $00  INIT MEMORY POINTER
003B A2 13      OLINE  LDXIM $13  INIT CHARACTER COUNTER
003D B9 00 02  OCHAR  LDAY $0200 GET CHARACTER FROM MEMORY
0040 C9 2A      CMPIM ASTER  TEST TERMINATOR
0042 F0 14      BEQ  EXIT  IF YES, THEN DONE
0044 20 BC E9   JSR  OUTALL ELSE, PRINT CHARACTER
0047 C8         INY      BUMP MEMORY POINTER
0048 CA         DEX      DECR CHARACTER COUNTER
0049 D0 F2      BNE  OCHAR IF NOT ZERO, CONTINUE
004B 20 93 E9   WAIT   JSR  INALL ELSE WAIT FOR A SPACE
004E C9 20      CMPIM SPACE FROM KEYBOARD TO CONTINUE
0050 D0 F9      BNE  WAIT  NOT A SPACE
0052 20 24 EA   JSR  CRCK  SPACE, SO PRINT
0055 4C 3B 00   JMP  OLINE THEN GET NEXT LINE

```

COMMON EXIT ROUTINE TO CLEAN UP THE DISPLAY AND RETURN TO MONITOR

```

0058 20 F0 E9  EXIT   JSR  CRLF  OUTPUT TO BLANK LINES
005B 20 F0 E9   JSR  CRLF
005E 00         BRK      THEN EXIT TO MONITOR

```

USER FUNCTION DEFINITIONS

```

010C          ORG  $010C

010C 4C 00 00  JMP  WRITE  F1 TO WRITE MESSAGE
010F 4C 1B 00  JMP  REM    F2 TO READ ENTIRE MESSAGE
0112 4C 36 00  JMP  ONELIN F3 TO READ ONE LINE AT A TIME

```

<K>*=0

/FF

```

0000 20 JSR E9F0
0003 A0 LDY #00
0005 A2 LDX #13
0007 20 JSR E993
000A 99 STA 0200,Y
000D C9 CMP #2A
000F F0 BEQ 0058
0011 C8 INY
0012 CA DEX
0013 D0 BNE 0007
0015 20 JSR EA24
0018 4C JMP 0005
001B 20 JSR E9F0
001E A0 LDY #00
0020 A2 LDX #13
0022 B9 LDA 0200,Y
0025 C9 CMP #2A
0027 F0 BEQ 0058
0029 20 JSR E9BC
002C C8 INY
002D CA DEX
002E D0 BNE 0022

```

```

0030 20 JSR EA24
0033 4C JMP 0020
0036 20 JSR E9F0
0039 A0 LDY #00
003B A2 LDX #13
003D B9 LDA 0200,Y
0040 C9 CMP #2A
0042 F0 BEQ 0058
0044 20 JSR E9BC
0047 C8 INY
0048 CA DEX
0049 D0 BNE 003D
004B 20 JSR E993
004E C9 CMP #20
0050 D0 BNE 004E
0052 20 JSR EA24
0055 4C JMP 003B
0058 20 JSR E9F0
005B 20 JSR E9F0
005E 00 BRK

```

<K>*=100

/3?

```

010C 4C JMP 0000
010F 4C JMP 001B
0112 4C JMP 0036

```

APPLE II® PROFESSIONAL SOFTWARE

PIE TEXT EDITOR

PIE (PROGRAMMA IMPROVED EDITOR) is a two-dimensional cursor-based editor designed specifically for use with memory-mapped and cursor-based CRT's. It is totally different from the usual line-based editors, which were originally designed for Teletypes. The keys of the system input keyboard are assigned specific PIE Editor function commands. Some of the features included in the PIE system are: Blinking Cursor; Cursor movement up, down, right, left, plus tabs; Character insert and delete; String search forwards and backwards; Page scrolling; GOTO line number, plus top or bottom of file; Line insert and delete anywhere on screen; Move and copy (single and multiple lines); Append and clear to end of line; Efficient memory usage. The following commands are available in the PIE Text Editor and each is executed by depressing the systems argument key simultaneously with the command key desired:

[LEFT]	Move cursor one position to the left
[RIGHT]	Move cursor one position to the right
[UP]	Move cursor up one line
[DOWN]	Move cursor down one line
[HOME]	Home cursor in lower left hand corner
[HOME]	Home cursor in upper left hand corner
[-PAG]	Move up (toward top of file) one "page"
[+PAG]	Move down (toward bottom of file) one "page"
[LTAB]	Move cursor left one horizontal tab
[RTAB]	Move cursor right one horizontal tab
[GOTO]	Go to top of file (line 1)
[ARG]n[GOTO]	Go to line 'n'
[BOT]	Go to bottom of file (last line + 1)
[-SCH]	Search backwards (up) into file for the next occurrence of the string specified in the last search command
[ARG]t[-SCH]	Search backwards for string 't'
[+SCH]	Search forwards (down) into the file for the next occurrence of the string specified in the last search command
[ARG]t[+SCH]	Search forward for string 't'
[APP]	Append -move cursor to last character of line +1
[INS]	Insert a blank line before the current line
[ARG]n[INS]	Insert 'n' blank lines before the current line
[DEL]	Delete the current line, saving it in the "push" buffer
[ARG]n[DEL]	Delete 'n' lines and save the first 20 in the "push" buffer
[DBLK]	Delete the current line as long as it is blank
[PUSH]	Save current line in "push" buffer
[ARG]n[PUSH]	Save 'n' lines in the "push" buffer
[POP]	Copy the contents of the "push" buffer before the current line
[CINS]	Enable character insert mode
[CINS][CINS]	Turn off character insert mode
[BS]	Backspace
[GOB]	Gobble - delete the current character and pull remainder of characters to right of cursor left one position
[EXIT]	Scroll all text off the screen and exit the editor
[ARG][HOME]	Home Line - scroll up to move current line to top of screen
[APP][APP]	Left justify cursor on current line
[ARG][GOB]	Clear to end of line
Apple PIE Cassette	16K \$19.95
TRS-80PIE Cassette	16K 19.95
Apple PIE Disk	32K 24.95

6502FORTH · Z-80FORTH 6800 FORTH

FORTH is a unique threaded language that is ideally suited for systems and applications programming on a micro-processor system. The user may have the interactive FORTH Compiler/Interpreter system running stand-alone in 8K to 12K bytes of RAM. The system also offers a built-in incremental assembler and text editor. Since the FORTH language is vocabulary based, the user may tailor the system to resemble the needs and structure of any specific application. Programming in FORTH consists of defining new words, which draw upon the existing vocabulary, and which in turn may be used to define even more complex applications. Reverse Polish Notation and LIFO stacks are used in the FORTH system to process arithmetic expressions. Programs written in FORTH are compact and very fast.

SYSTEM FEATURES & FACILITIES

Standard Vocabulary with 200 words
Incremental Assembler
Structured Programming Constructs
Text Editor
Block I/O Buffers
Cassette Based System
User Defined Stacks
Variable Length Stacks
User Defined Dictionary
Logical Dictionary Limit
Error Detection
Buffered Input

CONFIGURATIONS

AppleFORTH Cassette 16K	\$34.95
AppleFORTH Disk 32K	49.95
PatFORTH Cassette 16K	34.95
TRS-80FORTH Cassette 16K	34.95
SWTPCFORTH Cassette 16K	34.95

ASM/65 EDITOR ASSEMBLER

ASM/65 is a powerful, 2 pass disk-based assembler for the Apple II Computer System. It is a compatible subset of the FORTRAN cross-assemblers which are available for the 6500 family of micro-processors. ASM/65 features many powerful capabilities, which are under direct control of the user. The PIE Text Editor co-resides with the ASM/65 Assembler to form a comprehensive development tool for the assembler language programmer. Following are some of the features available in the ASM/65 Editor Assembler.

PIE Text Editor Command Repertoire
Disk Based System
Decimal, Hexadecimal, Octal, & Binary Constants
ASCII Literal Constants
One to Six character long symbols
Location counter addressing ""
Addition & Subtraction Operators in Expressions
High-Byte Selection Operator
Low-Byte Selection Operator
Source statements of the form:
[label] [opcode] [operand]
[;comment]
56 valid machine instruction mnemonics
All valid addressing modes
Equate Directive
BYTE Directive to initialize memory locations
WORD Directive to initialize 16-bit words
PAGE Directive to control source listing
SKIP Directive to control source listing
OPT Directive to set select options
LINK Directive to chain multiple text files
Comments
Source listing with object code and source statements
Sorted symbol table listing

CONFIGURATION

Apple II	48K/Disk	\$69.95
----------	----------	---------

LISA INTERACTIVE ASSEMBLER

LISA is a totally new concept in assembly language programming. Whereas all other assemblers use a separate or co-resident text editor to enter the assembly language program and then an assembler to assemble the source code, LISA is fully interactive and performs syntax/addressing mode checks as the source code is entered in. This is similar in operation to the Apple II Integer BASIC Interpreter. All error messages that are displayed are in plain, easy to understand English, and not simply an Error Code. Commands in LISA are structured as close as possible to those in BASIC. Commands that are included are: LIST, DELETE, INSERT, PR #n, IN #n, SAVE, LOAD, APPEND, ASM, and a special user-definable key envisioned for use with "dumb" peripherals. LISA is DISK II based and will assemble programs with a textfile too long to fit into the Apple memory. Likewise, the code generated can also be stored on the Disk, hence freeing up memory for even larger source programs. Despite these Disk features, LISA is very fast; in fact LISA is faster than most other commercially available assemblers for the Apple II. Not only is LISA faster, but also, due to code compression techniques used LISA requires less memory space for the text file. A full source listing containing the object and source code are produced by LISA, in addition to the symbol table

Apple II 32K/Disk \$34.95

PROGRAMMA INTERNATIONAL, INC.

3400 Wilshire Blvd.
Los Angeles, CA 90010

(213) 384-0579 · 384-1116 · 384-1117

Apple II is a registered trademark of Apple Computers, Inc. These professional products are available at your local computer dealer.

PROGRAMMA Software Products

S-C ASSEMBLER II Super Apple II Assembler

Chuck Carpenter
2228 Montclair Pl.
Carrollton, TX 75006

I've had the good fortune to get an advance copy of an excellent assembler for the Apple II. The assembler was written by Bob Sander-Cederlof and has many desirable features. Bob has used sweet 16 and several routines from the monitor and integer BASIC (it doesn't run with the Applesoft ROM on). The result is a compact co-resident two-pass assembler. A summary of assembler commands and data is listed in Table 1.

Here are a few of the assembler features:

- Format compatible with Apple mini-assembler
- Complete text editing using standard Apple screen and line editing features.
- Save and Load as in integer BASIC
- Psuedo op codes
- Text for REMs following the line no.
- Tabs to the opcode, operand and comment field using (CTRL) I
- Symbol table
- Listing, fast or slow
- Stop and start a LIST or ASM at any time
- Access Apple monitor from the assembler using \$
- Run programs from the assembler

The S-C ASSEMBLER II includes many other features. Among these are:

- Line renumbering starting at 1000 by 10's
- Printer driver routine - his or yours (or mine for that matter).
- Pagination of printed output
- Program location and relocation
- Can be used to renumber BASIC programs (except branches)
- Operates within DOS (see Table 2)
- Runs on an 8K machine

I have included a couple of examples of the S-C ASSEMBLER II features in Figure 1 and 2. Figure 1 is a functional routine. Figure 2 is merely for illustration of the .DA feature. Most of the assembler capability is illustrated in Figure 1. This routine, which compares 2 byte data, can be used for many applications such as extended loop counters. The example also includes ASCII strings using the pseudo op code .AS.

A jump to the user exit at \$3F8 was used to enter the data. This also takes advantage of the (CTRL) Y feature of the Apple monitor.

By calling the print routine with PRT, a hard copy of a listing or of assembled output is obtained. The printer driver routine is output from the game paddle connector. This is a TTL level serial signal. Typing SLO(W) or FAS(T) stops the printer output. Also, SLO(W) will provide a slow listing of your program. You can stop and start the listing with the space bar and, escape back to the assembler with a (RETURN). FAS(T) cancels SLO(W) returning to normal screen speed. (See Slow List, MICRO #5 page 21.)

For text editing, you can insert a line between other lines and list any single line or combination of lines. This allows character editing or line editing using Apple ESCAPE functions ((ESCAPE)D,C,B). Also you can DEL(ETE) any line or combination of lines.

An asterisk (*) in the first column of the label field allows that line to be a comment or blank line. Very useful for commenting a program. I used short comments in my programs; I only have 48 columns. Actually the comment can be any length (up to 100 characters or so). An asterisk used in the operand field means current location. You can add or subtract labels, hex and decimal values from the current location. Each of these can be added or subtracted, to or from, each other. Here are some examples:

```
1000 LAB1 LDA *-* CURRENT-CURRENT
1010 LAB2 LDA LAB1-LAB1
1020 LAB3 LDA *-LAB1
1030 LAB4 LDA LAB1+1234
1040 LAB5 LDA $1234-LAB1
1050 LAB6 LDA $ABCD-5678
1060 *
1070 * EXAMPLES OF ADDITION & SUBTRACTION OF
1080 * CURRENT VALUE, LABELS, DECIMAL AND
1090 * HEX VALUES FROM EACH OTHER.
1100 *
```

Illustration of the .DA feature is shown in Figure 2. The intent here is to show data in a single or 2 byte location. Once the data value has been assigned with the .DA code, it can be manipulated with another feature. This feature is shown as a / (slant line) and # (pound) in the first column of the operand field. Here's what's happening:

```
LDA /LAB1 = HIBYTE =  $\div 256$ 
LDA #LAB1 = LOBYTE = MOD256
```

As you can see from this and the previous examples, these features provide a very powerful assembler capability.

Before I obtained this assembler I could never get very enthusiastic about extensive machine or assembly language programming. Now, with this assembler, this coding is as easy as BASIC. You can get a copy for your Apple II from:

S-C SOFTWARE
P.O. Box 5537
Richardson, TX 75080
Price - \$25.00

I think you will enjoy it: having the efficiency of machine language programs developed with the ease of BASIC. The combination of compact programs with interactive capability makes personal computing even more enjoyable.

Load: *1000.1CFFR
 Run: *1000G Hard Entry
 or: *1003G Soft Entry

Pseudo ops:

label .OR expr origin (optional label)
 label .EQ expr equate
 label .DA expr data (optional label)
 label .HS xxxx...x hex string
 label .AS daaaa...ad ascii string (d is any delimiter)
 .EN end

Commands:

LOAD load program from tape
 SAVE save program to tape
 LIST list entire program
 LIST line# list selected line
 LIST line#,line# list range of lines
 DELETE line# delete selected line
 DELETE line#,line# delete range of lines
 RENUMBER rennumbers all lines
 NEW erase program
 SLOW program slow list
 FAST program fast list
 PRT printer driver \$1B77-1BFF
 ASM assemble program
 RUN expr execute starting at expr
 APPEND add program from tape to one in memory

Table 1
 S-C Assembler II Summary Notes

Instruction Steps:

1. Bring up DOS per instruction manual
2. Reset to monitor (*)
3. Load assembler from tape
4. Return to DOS using \$3DOG
5. BSAVE Assembler
6. LOCK Assembler
7. Call 4096 Jumps to Assembler
8. \$3DOG Jumps to DOS soft entry but...

At this point the DOS is clobbered. Any further use of DOS requires a reboot. It is very handy though to have the speed of loading the assembler from the disc.

Table 2
 S-C Assembler II with Apple II DOS

```

:ASM
1000 * .DA PSEUDO OP EXAMPLE
1010 *
1020            .OR $300
1030 HEX       .DA $1234
1040 DEC       .DA 4660
1050 *
1060 * ADDRESS OF DATA
1070 *
1080            LDA #HEX        HEX LO BYTE
1090            LDA /HEX        HEX HI BYTE
1100 *
1110 * DATA AT THE ADDRESS
1120 *
10308- AD 02 03    1130        LDA DEC        DEC LO BYTE
1030B- AD 03 03    1140        LDA DEC+1      DEC HI BYTE

1150            .EN
  
```

SYMBOL TABLE

HEX 0300 DEC 0302

Figure 2

DA Pseudo Op Example

MICRO 12:11

softside software

305 Riverside Drive, New York, N.Y. 10025
212-866-8058

the pet program.

1

GRAPHICS PAC

Quadruple your PET's graphic resolution. Do not be stuck with the PET's cumbersome 25X40 1000 point display. With the Graphics Pac you can *individually control 4000 points on screen*. It's great for *graphing, plotting, and gaming*. The Pac is a set of three programs with full documentation. PLOT places coordinate 0,0 in the screen's upper left hand corner. For more sophisticated applications the Pac includes GRAPH which plots point 0,0, in the center of the screen allowing you to *plot equations in all four quadrants*. As a *bonus* a Hi Res Doodle game is included. All this on a high quality cassette for \$9.95

2

ASSEMBLER 2001

is a full featured assembler for your PET micro-computer that follows the *standard 6502 set of machine language mnemonics*. Now you can write machine code programs. *Store your assembled programs, load them, run them, and even list your programs and various PET subroutines*. Unlike other assemblers this is one program! You do not have to go through a three tape process to edit and run a program. Of course to make more space you can trim out the features you do not need. Assembler 2001 allows you to run through the *USR of SYS commands*. This valuable program is offered at \$15.95.

3

BIKE

An *exciting new simulation* that puts you in charge of a bicycle manufacturing empire. Juggle inflation, breakdowns, seasonal sales variations, inventory, workers, prices, machines, and ad campaigns to keep your enterprise in the black. *Bike is dangerously addictive*. Once you start a game you will not want to stop. To allow you to take short rest breaks, Bike lets you store the data from your game on a tape so you can continue where you left off next time you wish to play. Worth a million in fun, we'll offer BIKE at \$9.95.

4

PINBALL

Dynamic usage of the PET's graphics features when combined with the fun of the *number 1 arcade game* equals an *action packed video spectacle* for your computer. Bumpers, chutes, flippers, free balls, gates, a jackpot, and a little luck guarantee a great game for all. \$9.95.

5

SUPER DOODLE

Give your PET a workout. This program really *puts the PET's graphics to work*. Super Doodle lets you use the screen of your PET like a *sketch pad*. Move a cursor in eight directions leaving a trail of any of the 256 charactrs the PET can produce. New features include an *erase key* that automatically remembers your last five moves, a return to center key, and clear control. *Why waste any more paper*, buy Super Doodle for only \$9.95.

6

DRIVING ACE

Non stop excitement with a fast moving, high paced version of your favorite video arcade racing games. Shift up! Shift Down! Watch your gas, and be careful on those hairpin turns. This dynamite tape has the two most common arcade racing games specially adapted to run on your PET computer. Driving Ace simulates an endless road packed with tight turns and gentle, but teasing, twists. Starting with fifty gallons of gas, how far can you go with a minimum of accidents? Grand Prix places you and your car on a crowded racing track. Race the clock and be careful steering around the fast but packed Grand Prix track. \$9.95

Dealer Rates On Request

A PET HEX DUMP PROGRAM

Joseph Donato
193 Walford Rd. E.
Sudbury, ONT., Canada

Have you PET owners ever wondered how it could be possible to look at your BASIC which resides in Read Only Memory (ROM)? To be able to look for routines entry points and other interesting codes in machine language?

This program will do just that. You can look at all memory locations in PET's BASIC which starts at 49152 decimal or C000 hexadecimal in memory. One is able for example to look at locations D71E through D890 where addition and subtraction routines are carried out, D8BF through D8FC where the log function is evaluated, D9E1 through DA73 where division is performed and many other locations where other routines are carried out.

A start for this program was provided by Mr. Herman's article of MICRO 7:47. Of course the same information was available in the Commodore Users Notes.

In any event I decided that the ultimate goal of the program would be to provide a memory dump of some sort in hexadecimal notation so that machine language instructions could easily be recognized.

The output of the program is formatted as a starting address followed by either 32 or 8 bytes of data per line, all in hexadecimal, depending on whether or not a printer is to be used. With the data bytes in hex notation it is very easy to correlate them with the 6502 microprocessor machine language instruction set.

The program listing has been thoroughly debugged and tested. Although the program was originally written for a PET with a Centronics printer, as I outlined in the REM's, the program will run on a "bare" PET with no problem.

The changes for a "bare" PET are as follows:

1. Omit line 10.
2. Change line 542 to read:
542 IF L<9 THEN 570
3. Omit all print statements and substitute instead the print format outlined in the REM's at lines 606 through 612. These print lines are to be placed at line 545, 546, 547, 548.
4. Notice that there is no comma or semicolon after the last print character. This is very important otherwise the format will be destroyed.

A considerable amount of time was spent on both versions of the program. No problems were encountered in running either version.

I hope that by following the machine language coding of the 6502 some of you will obtain a better understanding of PET's Basic 'inner workings'. Also some of you who have the T.I.M. monitor will be able to trace its subroutines and jumps to Basic. Perhaps it may inspire you in writing some machine language programs or routines.

I should add that if one wishes to look at different addresses other than the C000 (49152 decimal), all you need do is to change the starting address value "K" in line 240. This must be in decimal notation

I hope you get as much pleasure as I did 'sneaking a look' at PET's Basic.

```
1 REM *** A BASIC PET HEX DUMP ***
2 REM THIS PROGRAM WILL PEEK AT PET'S
3 REM MEMORY IN ROM STARTING AT A GIVEN ADDRESS 'K' (49152 DECIMAL) AND RETURN
4 REM THE CORRESPONDING DATA. ALL VALUES ARE CONVERTED TO HEXADECIMAL PRIOR TO
5 REM PRINTING. THE FORMAT IS: STARTING ADDRESS PLUS 32 OR 8 BYTES OF DATA,
6 REM PER LINE DEPENDING WHETHER OR NOT A PRINTER IS USED.
7 REM
8 REM THE COMMAND ON LINE 10 INITIALIZES THE PRINTER PORT. IT *MUST* BE OMITTED
9 REM IF A "BARE" PET IS USED.
10 OPEN 5,5:CMD 5
11 REM FOLLOWING IS A MACHINE LANGUAGE
12 REM ROUTINE WHICH RESIDES IN NUMBER 2 TAPE
13 REM BUFFER AREA. IT RETURNS THE CONTENTS OF THE CORRESPONDING MEMORY
14 REM LOCATIONS SPECIFIED BY 'K'.
15 POKE(1),58
16 POKE(2),3
17 POKE(826),32
20 POKE(827),167
30 POKE(828),208
40 POKE(829),166
```

```

50 POKE(830),179
60 POKE(831),164
70 POKE(832),180
80 POKE(833),134
90 POKE(834),180
100 POKE(835),132
120 POKE(836),179
130 POKE(837),162
140 POKE(838),00
150 POKE(839),161
160 POKE(840),179
170 POKE(841),168
180 POKE(842),169
190 POKE(843),00
200 POKE(844),32
210 POKE(845),120
220 POKE(846),210
230 POKE(847),96
232 REM SET UP STORAGE AREA FOR ONE
233 REM LINE OF HEX VALUES TO BE PRINTED
235 DIM N1$(40),NO$(40)
236 REM INITIALIZE CHARACTER COUNTER
237 L=1
238 REM THE VALUE OF 'K' DETERMINES
239 REM THE STARTING ADDRESS.
240 FOR K=49152 TO 65536
241 I=K
250 A=USR(K-65536)
255 REM LINES 270-530 CONSIST OF A SUBROUTINE TO CONVERT ALL VALUES FROM
256 REM DECIMAL TO HEXADECIMAL NOTATION
270 B%=16
280 D=A
390 H$="0123456789ABCDEF"
400 NO$(L)=""
405 N1$(L)=""
410 F%=LOG(I)/LOG(B%)
411 REM BECAUSE THE DECIMAL TO HEX ROUTINE
412 REM RETURNS A SINGLE '0' FOR VALUES
413 REM OF A=0, LINE 416 CONVERTS
414 REM ANY OF THESE ZERO VALUES TO
415 REM A DOUBLE HEX '00'.
416 IF A=0 THEN NO$(L)="00":GOTO 480
418 G%=LOG(D)/LOG(B%)
420 FOR J=G% TO 0 STEP -1
430 X=INT(B%^J)
440 C%=D/X
445 REM LINE 455 INSERTS A LEADING ZERO
446 REM IN HEXADECIMAL VALUES OF LESS
447 REM THAN 'F'(15). EX. '7'='07' ETC.
450 NO$(L)=NO$(L)+MID$(H$,C%+1,1)
455 IF A<16 THEN NO$(L)=('0'+NO$(L))
460 D=INT(D-C%*X)
470 NEXT J
480 FOR J=F% TO 0 STEP -1
490 X=INT(B%^J)
500 C%=INT(I/X)
510 N1$(L)=N1$(L)+MID$(H$,C%+1,1)
520 I=INT(I-C%*X)
530 NEXT J

```



```

532 REM SUBROUTINE FOR DECIMAL TO HEXADECIMAL CONVERSION ENDS HERE
535 L=L+1
536 REM LINE 542 CHECKS TO SEE IF THE
537 REM REQUIRED NUMBER OF CHARACTERS
538 PER LINE HAVE BEEN DONE. THE TEST VALUE
539 NUMBER 33 *MUST* BE CHANGED TO A NUMBER 9 IF A "BARE" PET IS USED.
542 IF L<>33 THEN 570
545 PRINT N1$(1)," ",NO$(1)," ",NO$(2)," ",NO$(3)," ",NO$(4)," ",NO$(5),
546 PRINT " ",NO$(6)," ",NO$(7)," ",NO$(8)," ",NO$(9)," ",NO$(10)," ",
547 PRINT NO$(11)," ",NO$(12)," ",NO$(13)," ",NO$(14)," ",NO$(15)," ",
548 PRINT NO$(16)," ",NO$(17)," ",NO$(18)," ",NO$(19)," ",NO$(20)," ",
549 PRINT NO$(21)," ",NO$(22)," ",NO$(23)," ",NO$(24)," ",NO$(25)," ",
550 PRINT NO$(26)," ",NO$(27)," ",NO$(28)," ",NO$(29)," ",NO$(30)," ",
560 PRINT NO$(31)," ",NO$(32)
565 L=1
570 NEXT K
600 REM THE PRINT STATEMENT FOR THE PET
602 REM WITH NO PRINTER "BARE" SHOULD BE AS FOLLOWS:
606 REM PRINT N1$(1);" ";NO$(1);" ";
608 REM NO$(2);" ";NO$(3);" ";NO$(4);
610 REM " ";NO$(5);" ";NO$(6);" ";
612 REM NO$(7);" ";NO$(8);" ";NO$(9)
615 END

```

```

0000 10 07 48 06 35 00 EF 07 05 0A DF 0A 70 0F 23 08 9C 08 9C 07 74 07 1F 08 00 07 7F 07 09 07 32 08
0020 1B 07 42 08 01 07 04 FF 07 FF 0A FF 34 02 F8 06 7E 09 9E 09 44 07 87 05 6F 07 94 09 00 FF BF FF
0040 02 FF 9E 0A 30 05 80 08 9E 08 2A 08 00 00 64 02 85 02 24 0E 45 0F BF 08 80 0E 9E 0F 85 0F EE 0F
0060 48 E0 E6 06 54 06 49 03 85 06 63 06 04 05 08 05 04 06 0F 06 79 3E 07 79 27 07 7B FF 08 7B E3 09
0080 7F 20 0E 50 08 0E 46 05 0E 70 66 0E 5A E7 0D 64 05 0F 45 4E 04 46 4F 02 4E 45 58 04 44 41 54 C1
00A0 49 4E 50 55 54 83 49 4E 50 55 04 44 49 0D 52 45 41 04 40 45 04 47 4F 54 0F 52 55 0E 49 06 52 45
00C0 53 54 4F 52 05 47 4F 53 55 02 52 45 54 55 52 0E 52 45 0D 53 54 4F 00 4F 0E 57 41 49 04 40 4F 41
00E0 04 53 41 56 05 56 45 52 49 46 09 44 45 05 50 4F 4B 05 50 52 49 4E 54 83 50 52 49 4E 04 43 4F 4E
0100 04 40 49 53 04 43 40 02 43 40 04 53 59 02 4F 50 45 0E 43 40 4F 53 05 47 45 04 4E 45 07 54 41 42
0120 80 54 0F 46 0E 53 50 43 80 54 40 45 0E 4E 4F 04 53 54 45 00 80 80 80 80 80 80 80 80 80 80 80 80
0140 8C 53 47 0E 49 4E 04 41 42 03 55 53 02 46 52 05 50 4F 03 53 51 02 52 4E 04 40 4F 07 45 58 00 43
0160 4F 03 53 49 0E 54 41 0E 41 54 0E 50 45 45 08 40 45 0E 53 54 52 84 56 41 00 41 53 03 43 48 52 84
0180 4C 45 46 54 84 52 49 47 48 54 84 40 49 44 84 00 4E 45 58 54 20 57 49 54 48 4F 55 54 20 46 4F 02
01A0 53 59 4E 54 41 08 52 45 54 55 52 4E 20 57 49 54 48 4F 55 54 20 47 4F 53 55 02 4F 55 54 20 4F 46
01C0 20 44 41 54 01 49 40 40 45 47 41 40 20 51 55 41 4E 54 49 54 09 00 00 00 00 00 4F 56 45 52 46 4C
01E0 4F 07 4F 55 54 20 4F 46 20 40 45 40 4F 52 09 55 4E 44 45 46 27 44 20 53 54 41 54 45 40 45 4E 04
0200 42 41 44 20 53 5E 42 53 43 52 49 50 04 52 45 44 49 40 27 44 20 41 52 52 41 09 44 49 56 49 53 49
0220 4F 4E 20 42 59 20 5A 45 52 0F 49 40 40 45 47 41 40 20 44 49 52 45 43 04 54 59 50 45 20 40 49 53
0240 40 41 54 43 08 53 54 52 49 4E 47 20 54 4F 4F 20 40 4F 4E 07 42 41 44 20 44 41 54 01 46 4F 52 40
0260 55 40 41 20 54 4F 4F 20 43 4F 40 50 40 45 08 43 41 4E 27 54 20 43 4F 4E 54 49 4E 55 05 55 4E 44
0280 45 46 27 44 20 46 55 4E 43 54 49 4F 0E 20 45 52 52 4F 52 00 20 49 4E 20 00 00 0A 52 45 41 44 59
02A0 2E 00 0A 00 00 0A 42 52 45 41 45 00 8A E8 E8 E8 80 81 81 09 81 00 21 85 99 00 0A 80 02 81 85
02C0 90 80 83 81 85 99 00 83 81 00 87 85 90 80 82 81 F0 87 8A 18 69 12 8A 00 08 68 20 2A C3 85 80 84
02E0 81 38 85 89 E5 8E 85 71 80 85 8A E5 8F 8A E8 90 F0 23 85 89 38 E5 71 85 89 80 83 06 8A 38 85 87
0300 E5 71 65 87 80 80 06 80 90 84 81 89 91 87 88 80 F9 81 89 91 87 06 8A 06 80 8A 80 F2 60 8A 69 36
0320 80 35 85 71 8A E4 71 90 2E 60 04 83 90 28 00 04 05 82 90 22 48 82 89 90 48 85 86 8A 10 8A 20 84
0340 04 82 F7 68 95 80 E8 30 8A 68 80 80 04 83 90 86 00 05 05 82 80 81 60 82 52 46 64 85 83 F0 87 20
0360 0C FF 89 80 85 83 20 02 09 20 47 8A 80 90 01 48 29 7F 20 49 8A E8 68 10 F3 20 84 05 89 80 80 02
0380 20 27 8A 8A 89 08 F0 83 20 94 0C 46 64 89 99 80 02 20 27 8A 20 68 04 86 09 84 8A 20 02 80 F0 F4
03A0 82 FF 86 89 90 06 20 80 04 4C E9 06 20 63 08 20 80 04 84 5C 20 22 05 90 44 80 81 81 8E 85 72 85

```

BREAK IN 240

READY.

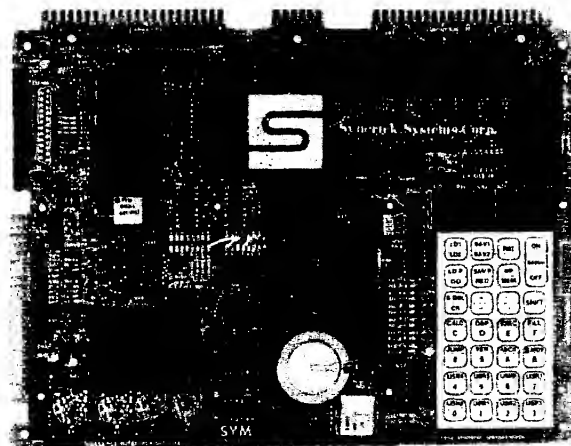
Example of a partial Hex Dump obtained with the Program

SYM-1, 6502-BASED MICROCOMPUTER

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Synertek has enhanced KIM-1* software as well as the hardware. The software has simplified the user interface. The basic SYM-1 system is programmed in machine language. Monitor status is easily accessible, and the monitor gives the keypad user the same full functional capability of the TTY user. The SYM-1 has everything the KIM-1* has to offer, plus so much more that we cannot begin to tell you here. So, if you want to know more, the SYM-1 User Manual is available, separately.

SYM-1 Complete w/manuals **\$269.00**
SYM-1 User Manual Only **7.00**
SYM-1 Expansion Kit **75.00**

Expansion includes 3K of 2114 RAM chips and 1-6522 I/O chip.

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All products that we manufacture are designed to meet or exceed industrial standards. All components are first quality and meet full manufacturer's specifications. All this and an extended burn-in is done to reduce the normal percentage of field failures by up to 75%. To you, this means the chance of inconvenience and lost time due to a failure is very rare; but, if it should happen, we guarantee a turn-around time of less than forty-eight hours for repair.

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This motherboard uses the KIM-4* bus structure. It provides eight (8) expansion board sockets with rigid card cage. Separate jacks for audio cassette, TTY and power supply are provided. Fully buffered bus.

VAK-1 Motherboard **\$129.00**

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VAK-2 16K RAM Board with only **\$239.00**

8K of RAM (1/2 populated)

VAK-3 Complete set of chips to **\$175.00**

expand above board to 16K

VAK-4 Fully populated 16K RAM **\$379.00**

VAK-5 2708 EPROM PROGRAMMER

This board requires a +5 VDC and +12 VDC, but has a DC to DC

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VAK-5 2708 EPROM Programmer **\$269.00**

VAK-6 EPROM BOARD

This board will hold 8K of 2708 or 2758, or 16K of 2716 or 2516 EPROMs. EPROMs not included.

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VAK-7 COMPLETE FLOPPY-DISK SYSTEM (May '79)

VAK-8 PROTOTYPING BOARD

This board allows you to create your own interfaces to plug into the motherboard. Etched circuitry is provided for regulators, address and data bus drivers; with a large area for either wire-wrapped or soldered IC circuitry.

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SUPER HI-LO FOR THE SYM-1

Jack Gieryic
2041 138th Ave. N.W.
Andover, MN 55303

Super HI-Lo has a new twist to the game. This program fits into the standard 1K SYM and execution begins at location 200. The left two LED digits are your upper limit (initialized to 99) and the middle two digits are your lower limit (initialized to 00). SYM picks a random number and you attempt to guess it. Your attempt count is seen in the right two digits. The right digit will blink when it's your last guess.

After entering the command GO 200 CR press any key to start the contest. Enter your two digit guess (decimal only) and hit the "A" key. Win or loose you get an appropriate message at the end after which the LED's go blank. Hit any key and you are ready for a second game. If you didn't guess the number then you will be given one more chance in the next game. If you are lucky enough to guess the number then you will have one less chance the next game.

For you SYMMERS who are interested in taking things one step further, you will find MESSAG an interesting subroutine you may want to incorporate in your own programs. This code is entirely

relocatable except for the first four instructions which must be calculated if the code is moved. The routine uses page zero locations OD, OE, OF and 10, but you can change that too if necessary. The A and X registers contain the message buffer address per comments in the program. This message buffer contains segment codes which will light up any combination of LED segments.

Refer to Figure 4-6 Keyboard/Display Schematic in your reference manual for the LED segments in the lower right corner. Segment "a" is turned on by setting bit 0 to a one in a message buffer entry. Segment "b" is controlled by bit 1 and so on with segments c, d, e, f, g and the decimal point. Thus a hex 5C is a lower case O (segments c, d, e, and g). Feel free to change either message but don't forget to add a few OO characters at the start and end of your message. If you relocate the message buffer then change the register parameters prior to the call to MESSAG.

One other note on the program. By changing the value at location 206 you can alter the rate at which the right LED will blink when you reach your last chance.

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JOHN GIERVIC
APRIL 1979

SYM REFERENCES

035E	KYSTAT *	\$896A
035E	ACCESS *	\$8B86
035E	OUTBYT *	\$82FA
035E	SCAND *	\$8906
035E	KEY0 *	\$8923
035E	GETKEY *	\$88AF
035E	ASCNIB *	\$8275
035E	DISBUF *	\$A640
035E	RDIG *	\$A645

MESSAGE POINTERS

035E	MFAIL *	\$0360
035E	MSUCC *	\$0380

0000	ORG	\$0000
------	-----	--------

0000 00	UPP =	\$00	UPPER NUMBER
0001 00	LOW =	\$00	LOWER NUMBER
0002 00	ACNT =	\$00	ATTEMPT COUNT
0003 00	RAN =	\$00	RANDOM NUMBER 2 - 98
0004 00	TEMP =	\$00	
0005 00	UGES =	\$00	GUESS UNITS
0006 00	TGES =	\$00	GUESS TENS
0007 00	BLINK =	\$00	BLINK FLAG 1 = BLINK
0008 00	TDIG =	\$00	SAVE RDIG
0009 00	DARK =	\$00	1 = DARK
000A 00	LATT =	\$00	ATTEMPT LIMIT
000B 00	ONOFF =	\$00	BLINKING
000C 00	BLIM =	\$00	BLINKING LOOP COUNT INIT.
000D 00	COUNT =	\$00	
000E 00	LOOPA =	\$00	
000F 00	LOOPB =	\$00	
0010 00	CLIM =	\$00	MESSAGE LIMIT

0200	ORG	\$0200	PROGRAM ORIGIN
------	-----	--------	----------------

0200 20 86 8B	BEGIN	JSR ACCESS	
0203 A9 60		LDAIM \$60	INIT BLINKING LOOP LIMIT
0205 85 0C		STA BLIM	
0207 A9 06		LDAIM \$06	INIT ATTEMPT COUNTER
0209 85 0A		STA LATT	
020B A9 63	TILL	LDAIM \$63	INIT UPPER LIMIT
020D 85 00		STA UPP	
020F A9 00		LDAIM \$00	INIT BLINK FLAG
0211 85 07		STA BLINK	
0213 85 01		STA LOW	LOWER LIMIT
0215 85 02		STA ACNT	ATTEMPT COUNT
0217 A9 01		LDAIM \$01	

0219 85 03		STA	RAN	RANDOM NUMBER
021B E6 03	INCRAN	INC	RAN	INCREMENT RANDOM NUMBER
021D A5 03		LDA	RAN	
021F C9 63		CMPIM	\$63	IF EQUAL 99 DECIMAL
0221 D0 04		BNE	KEYIN	
0223 A9 02		LDAIM	\$02	THEN RESET TO 2
0225 85 03		STA	RAN	
0227 20 6A 89	KEYIN	JSR	KYSTAT	IS A KEY DOWN?
022A 90 EF		BCC	INCRAN	LOOP UNTIL ONE IS DOWN
022C A5 00	LIMITS	LDA	UPP	PUT UPPER, LOWER AND
022E 20 00 03		JSR	HTDEC	ATTEMPT COUNT IN
0231 20 FA 82		JSR	OUTBYT	DISPLAY BUFFER
0234 A5 01		LDA	LOW	
0236 20 00 03		JSR	HTDEC	
0239 20 FA 82		JSR	OUTBYT	
023C A5 02		LDA	ACNT	
023E 20 00 03		JSR	HTDEC	
0241 20 FA 82		JSR	OUTBYT	
0244 20 06 89	DISP	JSR	SCAND	LIGHT LED
0247 20 23 89		JSR	KEYQ	IF KEY IS DOWN,
024A D0 30		BNE	READK	
024C A5 07		LDA	BLINK	IF BLINKING IS REQUESTED
024E C9 01		CMPIM	\$01	
0250 D0 F2		BNE	DISP	
0252 A5 0B		LDA	ONOFF	IF TIME TO TURN CHARACTER ON
0254 D0 21		BNE	INCLOP	
0256 A5 09		LDA	DARK	IF TURN CHAR. OFF
0258 C9 01		CMPIM	\$01	
025A D0 0E		BNE	RIGHT	
025C AD 45 A6		LDA	RDIG	THEN GET CHARACTER
025F 85 08		STA	TDIG	SAVE IT
0261 A9 00		LDAIM	\$00	SET RIGHT DIGIT BLANK
0263 8D 45 A6		STA	RDIG	
0266 C6 09		DEC	DARK	SWITCH FLAG
0268 F0 07		BEQ	LCOUNT	
026A A5 08	RIGHT	LDA	TDIG	ELSE RESTORE RIGHT DIGIT
026C 8D 45 A6		STA	RDIG	
026F E6 09		INC	DARK	SWITCH FLAG
0271 A5 0C	LCOUNT	LDA	BLIM	RESET LOOP COUNTER
0273 85 0B		STA	ONOFF	
0275 D0 CD		BNE	DISP	
0277 E6 0B	INCLOP	INC	ONOFF	INCR. LOOP COUNTER
0279 4C 44 02		JMP	DISP	LOOP
027C 20 AF 88	READK	JSR	GETKEY	GET DEPRESSED KEY
027F 20 75 82		JSR	ASCNIB	
0282 C9 0A		CMPIM	\$0A	IS IT "A" (ATTEMPT)
0284 F0 0B		BEQ	SETLOP	YES
0286 AA		TAX		NO
0287 A5 05		LDA	UGES	MOVE PREVIOUS KEY
0289 85 06		STA	TGES	TO TENS DIGIT
028B 8A		TXA		
028C 85 05		STA	UGES	PUT NEW KEY INTO UNITS

028E 4C 44 02		JMP	DISP	LOOP	
0291 A6 06	SETLOP	LDX	TGES	SET LOOP INDEX (TENS)	
0293 A9 00		LDAIM	\$00	INIT A REGISTER	
0295 18		CLC		CLEAR CARRY FLAG	
0296 CA	DECX	DEX		DECR. X REG.	
0297 30 04		BMI	ADUNIT	IF NEG, THEN FINISHED	
0299 69 0A		ADCIM	\$0A	ELSE ADD 10	
029B D0 F9		BNE	DECX	LOOP	
029D 65 05	ADUNIT	ADC	UGES	ADD UNITS VALUE	
029F C5 03		CMP	RAN	COMPARE TO RANDOM	
02A1 D0 03		BNE	ADUP		
02A3 4C E4 02		JMP	SUCEED	GUESS = RANDOM	
02A6 90 09	ADUP	BCC	TLOW		
02A8 C5 00		CMP	UPP		
02AA 80 0B		BCS	INCA		
02AC 85 00	RUP	STA	UPP	REPLACE UPPER WITH GUESS	
02AE 4C B7 02		JMP	INCA		
02B1 C5 01	TLOW	CMP	LOW		
02B3 90 02		BCC	INCA		
02B5 85 01		STA	LOW	REPLACE LOWER WITH GUESS	
02B7 E6 02	INCA	INC	ACNT	INCR. ATTEMPT COUNT	
02B9 A5 02		LDA	ACNT	LIMIT REACHED?	
02BB C5 0A		CMP	LATT		
02BD D0 03		BNE	TEST	NO	
02BF 4C D8 02		JMP	FAIL	YES = FAILURE	
02C2 38	TEST	SEC			
02C3 A5 0A		LDA	LATT	LAST ATTEMPT COMING UP	
02C5 E5 02		SBC	ACNT		
02C7 C9 01		CMPIM	\$01		
02C9 D0 0A		BNE	WAIT	NO	
02CB E6 07		INC	BLINK	YES - INIT FOR BLINKING	
02CD A5 0C		LDA	BLIM		
02CF 85 0B		STA	ONOFF		
02D1 A9 01		LDAIM	\$01		
02D3 85 09		STA	DARK		
02D5 4C 2C 02	WAIT	JMP	LIMITS	GO WAIT FOR NEXT ATTEMPT	
02D8 E6 0A	FAIL	INC	LATT	FAILURE = INCR ATTEMPT LIMIT	
02DA A2 03		LDXIM	MFAIL	/ MESSAGE HI BYTE	
02DC A9 60		LDAIM	MFAIL	MESSAGE LO BYTE	
02DE 20 17 03		JSR	MESSAG	DISPLAY FAILURE MESSAGE	
02E1 4C 0B 02		JMP	TILL	RESTART HI-LO	
02E4 C6 0A	SUCEED	DEC	LATT	SUCCESS = DECR ATTEMPT LIMIT	
02E6 A2 03		LDXIM	MSUCC	/ MESSAGE HI BYTE	
02E8 A9 80		LDAIM	MSUCC	MESSAGE LO BYTE	
02EA 20 17 03		JSR	MESSAG	DISPLAY SUCCESS MESSAGE	
02ED 4C 0B 02		JMP	TILL	RESTART HI-LO	

SUBROUTINE HTDEC

ENTRY JSR HTDEC

THIS ROUTINE WILL CONVERT A HEX NUMBER
TO DECIMAL. UPON ENTRY THE A REGISTER CONTAINS
THE NUMBER TO CONVERT. UPON EXIT THE A REG.
CONTAINS THE UNITS DIGIT AND THE X REGISTER
CONTAINS THE TENS DIGIT.

```

0300                      ORG    $0300

0300 A2 00      HTDEC  LDXIM $00      INIT TENS COUNT
0302 38                      SEC
0303 E9 0A      HTA    SBCIM $0A      SUBTRACT 10 DECIMAL
0305 30 03                      BMI   HTB
0307 E8                      INX      INCR. TENS DIGIT
0308 D0 F9                      BNE   HTA
030A 69 0A      HTB    ADCIM $0A      UNITS DIGIT
030C 85 04                      STA   TEMP
030E 8A                      TXA
030F 18                      CLC
0310 2A                      ROLA
0311 2A                      ROLA
0312 2A                      ROLA
0313 2A                      ROLA
0314 65 04      ADC    TEMP
0316 60                      RTS

```

SUBROUTINE MESSAG

ENTRY JSR MESSAG

THIS ROUTINE WILL PARADE THE MESSAGE SPECIFIED
BY THE CALLER ACROSS THE LEDS. THE A REGISTER
CONTAINS THE LO BYTE OF THE MESSAGE ADDRESS. THE
X REG. CONTAINS THE HI BYTE OF THE MESSAGE ADDRESS.
THE FIRST BYTE OF THE MESSAGE CONTAINS THE NUMBER
OF BYTES IN THE MESSAGE MINUS 5. THIS COUNT
INCLUDES THE FIRST BYTE

```

0317 8D 24 03  MESSAG STA   MAD    +01 CHANGE INSTRUCTION
031A 8E 25 03          STX   MAD    +02
031D 8D 37 03          STA   MADX   +01 CHANGE INSTRUCTION
0320 8E 38 03          STX   MADX   +02
0323 AD FF FF  MAD    LDA   $FFFF  ADDRESS WILL BE CHANGED
0326 85 10          STA   CLIM
0328 A9 00          LDAIM $00
032A 85 0D          STA   COUNT
032C 85 0E          STA   LOOPA
032E 85 0F          STA   LOOPB
0330 E6 0D          INC   COUNT
0332 A4 0D  MESS    LDY   COUNT
0334 A2 00          LDXIM $00
0336 B9 FF FF  MADX  LDAY   $FFFF  ADDRESS WILL BE CHANGED
0339 9D 40 A6          STAX  DISBUF
033C C8              INY
033D E8              INX
033E E0 06          CPXIM $06
0340 D0 F4          BNE   MADX

```

0342 E6 0D	INC	COUNT
0344 20 06 89 MESSA	JSR	SCAND
0347 E6 0E	INC	LOOPA
0349 D0 F9	BNE	MESSA
034B E6 0F	INC	LOOPB
034D A5 0F	LDA	LOOPB
034F C9 02	CMPIM	\$02
0351 D0 F1	BNE	MESSA
0353 A5 0E	LDA	LOOPA
0355 85 0F	STA	LOOPB
0357 A5 0D	LDA	COUNT
0359 C5 10	CMP	CLIM
035B D0 D5	BNE	MESS
035D 60	RTS	

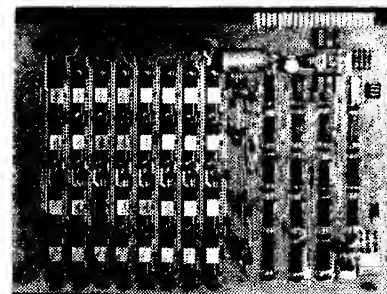
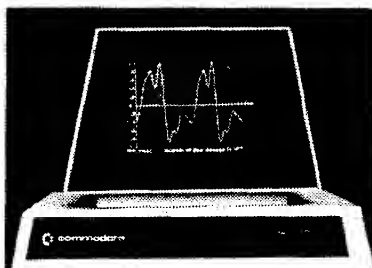
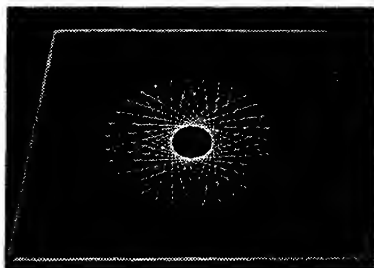
THE FAILURE MESSAGE BEGINS AT LOCATION 0360.
THE FIRST BYTE IS THE HEX NUMBER OF BYTES IN
THE MESSAGE MINUS FIVE. THE MESSAGE IS IN THE
FORM OF SEGMENT CODES. A MEMORY LISTING FOLLOWS.
LOAD THIS BEGINNING AT LOCATION 0360.

```
0360 0B 00 00 6E 3F 3E 00 38 3F 3F
0368 3F 3F 6D 79 00 00 00 00
```

THE SUCCESS MESSAGE BEGINS AT LOCATION 0380.

```
0380 08 00 00 39 5C 50 50 79
0388 58 78 00 00 00
```

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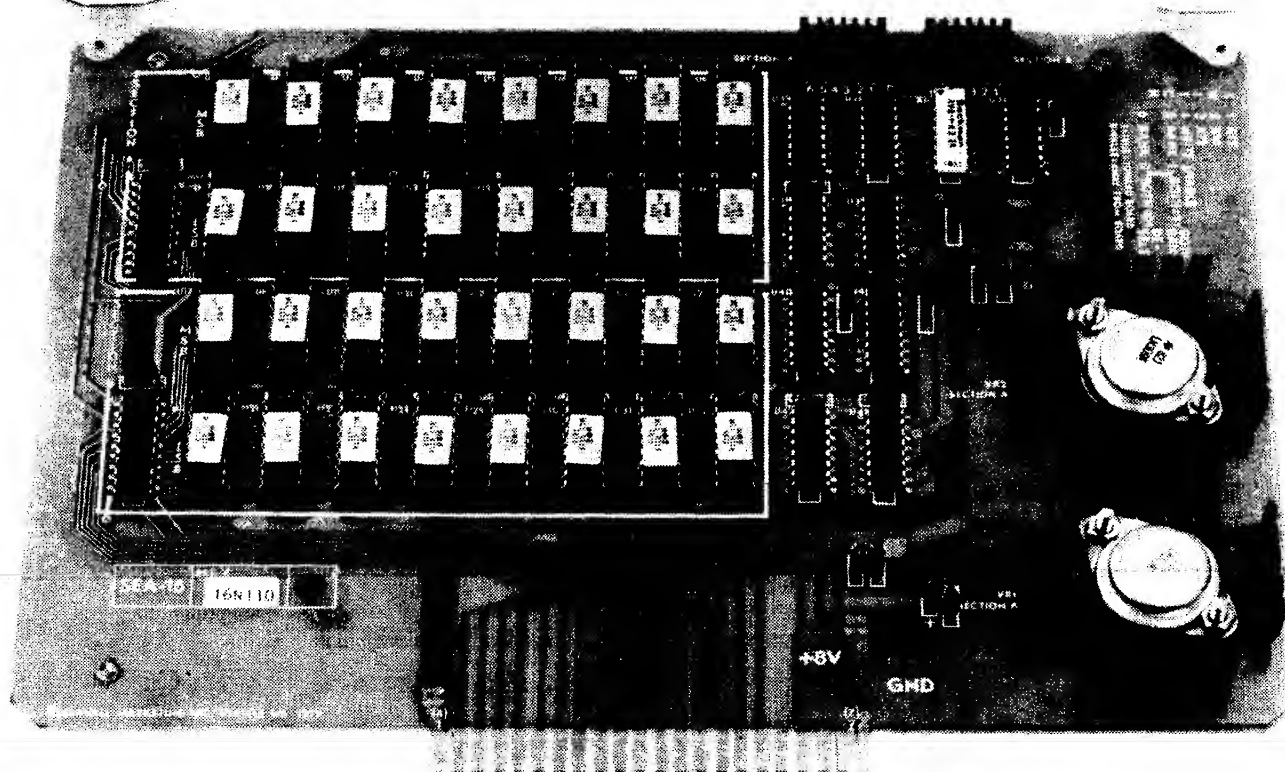
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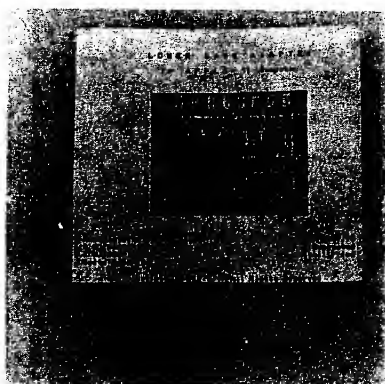
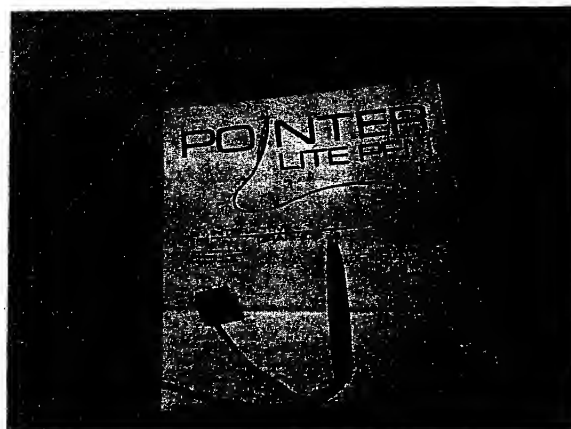
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A 100 μ S 16 CHANNEL ANALOG TO DIGITAL CONVERTER FOR 65XX MICROCOMPUTER SYSTEMS

J. C. Williams
55 Holcomb St.
Simsbury, CT 06070

Analog to digital (A/D) conversion can be useful in many microcomputer systems. The design presented here takes advantage of a large scale integrated circuit, the ADC0817, to simplify a 16 channel, 8 bit A/D system which can be attached to the bus of 65XX microcomputers. The applications that I have found for this system have included "straight" data acquisition, game joystick position reading, graphic input generation and voice recognition. Of course, the software for each of these applications is different, but they all require multichannel, reasonably fast A/D.

The 100 μ s conversion time of this system depends only on the 1 MHz clock frequency of the microcomputer. The microprocessor is not involved in the A/D conversions. Once the conversion is started, the processor can work on other tasks until the digital result is available.

The Hardware

This device appears to the programmer as a block of memory starting at a base address, BASE, and extending through 16 locations to BASE + 15. (The actual circuit described occupies 256 locations because of incomplete decoding.) An analog to digital conversion of a selected channel, say channel X, is started by writing to BASE + X. The 8 bit conversion result may then be read from any location in the block (eg. BASE) any time after the 100 μ S conversion time has elapsed. If desired, the end of conversion signal from the ADC0817 may cause an interrupt to get the attention of the processor. If multiple A/D conversions at the maximum speed are required the 65XX can be kept busy with "housekeeping" during the conversion delay time. The example programs illustrate two ways the converter may be driven. The system uses just five integrated circuits and can be built for less than \$40. The design, shown in Figure 1, occupies a six square inch area on a Vector plugboard and draws only 60 mA of current from the +5 Volt DC unregulated power supply. Operation of the circuit is simple because the ADC0817 performs all analog switching and A/D functions. The base address of the converter is fixed by six switches attached to the DM8131 six bit comparator. When the processor accesses memory locations having address bits A15-A10 matching the switch settings, the DM8131 output goes low. This output is NOR'ed with A9 and A8 to further reduce the memory space occupied by the circuit to one 65XX page. The possible base addresses which can be obtained with this decoder can fall on any 1K boundary and A9 and A8 must be "0's". For example, base addresses (in hex) can be set to A000 or A400 but not A100, A200, or A300. In the design drawn, A9 and A8 must be low for the A/D to be selected, but this could be changed if A9 and/or A8 were inverted using unused sections of the 74LS05. When the A/D is selected, the output of the NOR gate (pin 12 of the 74LS27) goes to a "1"; this can be used as a "board selected" signal if needed (eg. by KIM-1 users for DECODE ENABLE). The microprocessor R/W and O2 lines, along with an inverted board select signal and combined in two NOR gates which 1) latch channel select bits A3-A0 and start A/D conversion during O2 of write cycles and 2) enable the tri-state data bus drivers during O2 of

read cycles. The end of conversion (EOC) signal, produced by the ADC0817 when the most recent conversion has been completed, can be connected to a processor interrupt line through one of the 74LS05 open collector inverters. These interrupts must be cleared by starting another A/D conversion.

Wire-wrap construction is suitable for the circuit and component layout is not critical. It is good practice, however, to orient the analog input area away from digital circuits. The REF + and REF- reference voltages must not be noisy if the full accuracy, 20 mV per bit, is to be achieved. The +5 Volt regulator should not be shared with other circuitry. The layout used in one of the prototypes is sketched in Figure 2. Figure 2 also shows several input connections which may be useful. The circuit has two limitations: 1) input voltages must be between 0 and +5 Volts and 2) signals being converted should not change appreciably during the 100 μ s conversion period. Both of these limitations may be eliminated by appropriate analog conditioning circuitry, but the simplicity of the design is lost. Builders who want to add features to the circuit should consult the ADC0817 specification and application information.

The Software

Two example subroutines which use the A/D converter illustrate how it is handled by software. The program which calls the A/D subroutine must initialize both the channel selection and storage defining parameters before the JSR instruction is executed. In the examples, an index register contains the channel selection information because of the ease of using an indexed addressing mode to start a conversion. Data storage is either on page 0 or pointed to by page 0 variables. The A/D subroutines must either contain delays or take enough time between writing to and reading from the ADC0817 to allow it to finish the conversion. Components for this very useful piece of hardware can be obtained from a number of sources readily available to low-volume users. Both National Semiconductor and Texas Instruments produce the ADC0817 and its more accurate counterpart, the ADC0816. The ADC0817 and its data sheet have been recently listed by TRI-TEK, Inc., 7808 N. 27th Ave., Phoenix, AZ 85021. Many other suppliers, such as Jameco Electronics, 1021 Howard Avenue., San Carlos, CA 94979, and Advanced Computer Products, 1310 "B" E. Edinger, Santa Ana, CA 92713, can supply the other components.

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MCAD - MULTI-CHANNEL A/D CONVERSION
J. C. WILLIAMS
JANUARY 1979

0200		ORG	\$0200	
0200	BASE	*	\$B000	BASE ADDRESS OF ADC0816
0200	STORE	*	\$9000	START OF 16 BYTE STORAGE AREA
0200 9D 00 B0	MCAD	STAX	BASE	START CONVERSION ON CHANNEL X
0203 A0 0E		LDYIM	\$0E	DELAY FOR CONVERSION,
0205 88	DY	DEY		MINIMUM VALUE = \$0E
0206 D0 FD		BNE	DY	
0208 AD 00 B0		LDA	BASE	GET CONVERTED DATA
020B 9D 00 90		STAX	STORE	STORE DATA
020E CA		DEX		
020F 10 EF		BPL	MCAD	DO NEXT CHANNEL
0211 60		RTS		FINISHED

EXAMPLE CALLING ROUTINE FOR MCAD

0212 A2 0F	MCMAIN	LDXIM	\$0F	SELECT CONVERSION OF ALL
0214 20 00 02		JSR	MCAD	16 CHANNELS AND GO TO SUBROUTINE
0217 00		BRK		EXIT ** BE SURE TO INIT IRQ VECTOR **

CXAD SUBROUTINE
J. C. WILLIAMS
JANUARY 1979

```

0300          ORG    $0300

0300          BASE   *    $8000  BASE ADDRESS OF ADC0816
0300          SP     *    $0000  STORAGE POINTER
0300          SPSTR  *    $0002  LOC OF STORAGE BLOCK START ADDRESS
0300          SPSTP  *    $0004  LOC OF STORAGE BLOCK END ADDRESS


0300 9D 00 B0  CXAD   STAX  BASE  START FIRST CONVERSION
0303 A5 02      LDAZ  SPSTR  INIT STORAGE POINTER
0305 85 00      STAZ  SP
0307 A5 03      LDAZ  SPSTR  +01
0309 85 01      STAZ  SP      +01
030B D8         CLD          USE BINARY MODE
030C A0 05      LDYIM $05    INSERT DELAY TO ALLOW
030E 88         DEY          INITIAL CONV. TO COMPLETE
030F D0 FD      BNE  DY
0311 F0 16      BEQ  DELAY
0313 A5 00      TSTEND LDAZ  SP  TEST FOR END OF
0315 C5 04      CMPZ  SPSTP  STORAGE BLOCK
0317 A5 01      LDAZ  SP      +01
0319 E5 05      SBCZ  SPSTP  +01
031B 80 1D      BCS  RT
031D A9 01      LDAIM $01    ADD ONE TO STORAGE POINTER
031F 65 00      ADCZ  SP
0321 85 00      STAZ  SP
0323 A9 00      LDAIM $00
0325 65 01      ADCZ  SP      +01
0327 85 01      STAZ  SP      +01
0329 A0 05      DELAY LDYIM $05 DELAY TO FIX TIME BETWEEN CONV'S.
032B 88         DYA  DEY
032C D0 FD      BNE  DYA
032E AD 00 B0   LDA  BASE  READ CONVERTED RESULT
0331 9D 00 B0   STAX  BASE  START NEXT CONVERSION IMMEDIATELY
0334 A0 00      LDYIM $00    SET STORAGE OFFSET
0336 91 00      STAIY SP     STORE RESULTS
0338 F0 D9      BEQ  TSTEND  ALWAYS TAKEN
033A 60         RT          RTS

```

EXAMPLE CALLING ROUTINE FOR CXAD

```

033B A2 00  CXMAIN LDXIM $00  SELECT CHANNEL 0
033D A9 00      LDAIM $00    SET STARTING ADDRESS OF
033F 85 02      STAZ  SPSTR  STORAGE BLOCK TO $9000
0341 A9 90      LDAIM $90
0343 85 03      STAZ  SPSTR  +01
0345 A9 FF      LDAIM $FF    SET ENDING ADDRESS OF
0347 85 04      STAZ  SPSTP  STORAGE BLOCK TO $9FFF
0349 A9 9F      LDAIM $9F
034B 85 05      STAZ  SPSTP  +01
034D 20 00 03  JSR  CXAD
0350 00         BRK          EXIT  ** BE SURE TO INIT IRQ VECTOR **

```

16 CHANNEL ANALOG TO DIGITAL CONVERTER SYSTEM
FOR 65XX MICROPROCESSOR SYSTEMS

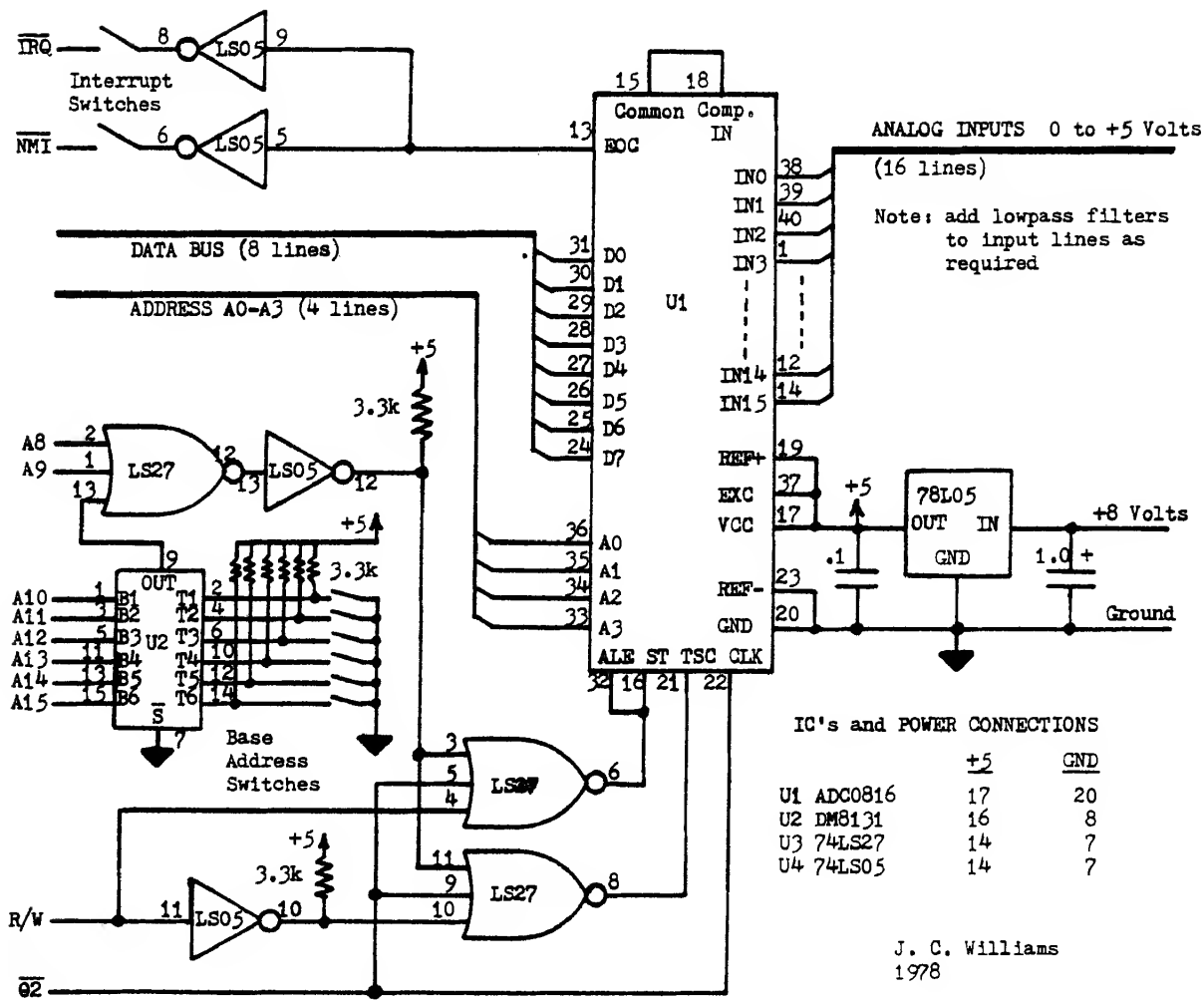
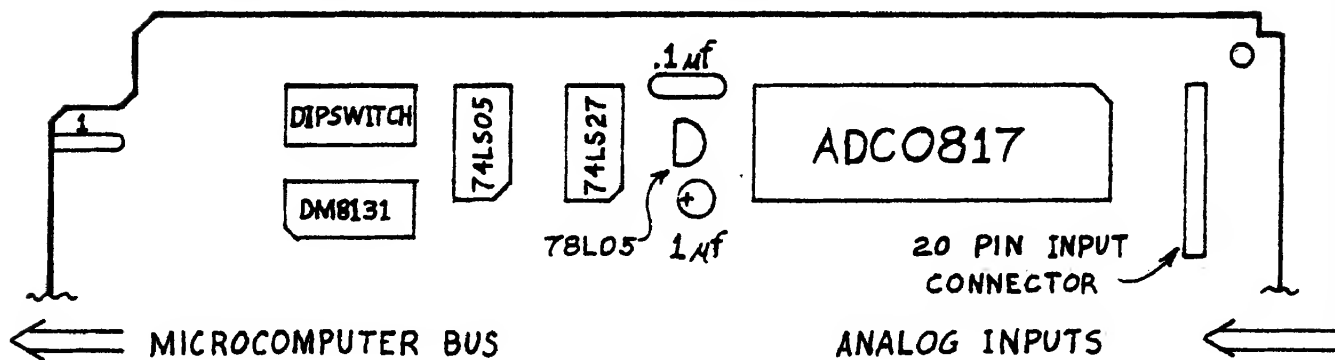


FIGURE 2

16 CHANNEL A/D CONVERTER FOR 65XX SYSTEMS

COMPONENT SIDE OF 6.5" X 4.5" PROTOTYPING CARD - VECTOR 3662

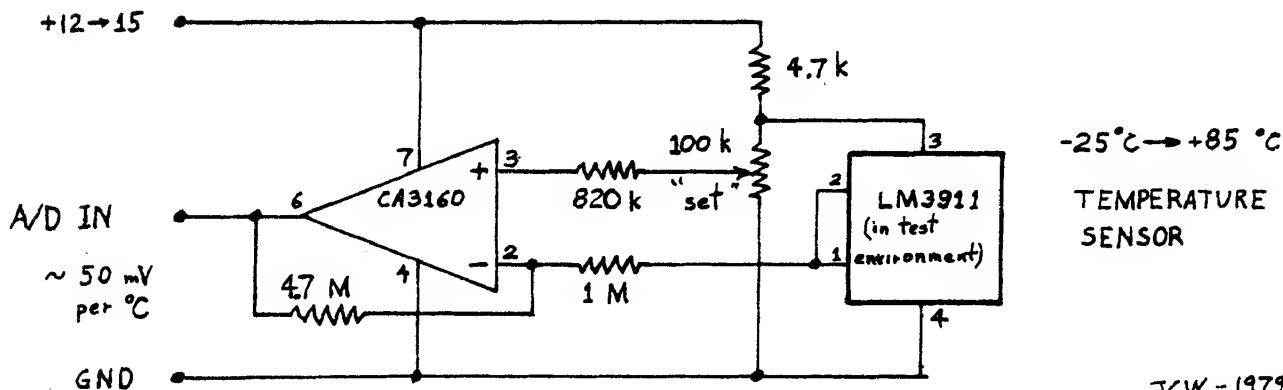
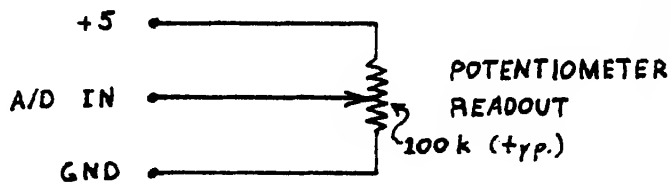
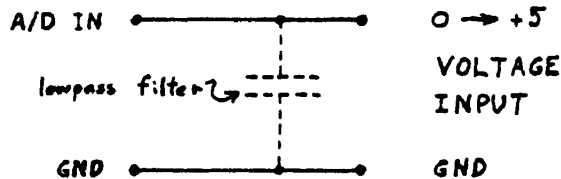


INPUT CONNECTOR DETAIL

TOP VIEW

GND	..	+5
IN14	..	IN15
IN12	..	IN13
IN10	..	IN11
IN8	..	IN9
IN6	..	IN7
IN4	..	IN5
IN2	..	IN3
IN0	..	IN1
GND	..	+5

APPLICATIONS



JCW - 1979



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REAL-TIME GAMES ON OSI

David Morganstein
9523 48th Place
College Park, MD 20704

This note discusses how real-time games can be written for OSI Challenger systems which use a serial terminal run from the ACIA. The terminal in my system is an ADM-3A, but the same principal applies to any other. The sample program which is included does use the cursor control procedure of the ADM-3A, but it is a common enough terminal that many readers will be able to use it directly. The cursor control is accomplished in a one-line subroutine and can be changed to another procedure easily.

My original goal was to write video games, but I did not have a separate TV monitor, 440 video board and A/D convertor to do this. Fortunately, there was a way!! First, I'll discuss a procedure for polling the serial terminal keyboard and then the video display on the terminal.

The basic idea was to use a PEEK command rather than an INPUT statement. That way the program does not have to stop while the player ponders his response. This was the ONLY way to play Lunar Lander. The typical version gives the Captain unlimited time to ponder his response and minimizes crash landings. Several articles in BYTE and elsewhere talk about using A/D convertors and joysticks. Of course, this is a fine way to go, but the same effect can be created without the added hardware.

The input byte from the ACIA appears at \$FC01. To get a little appreciation for this, look at the ROM monitor routine starting at \$FE00, this is called INCH in the OSD documentation. (See Figure 1.) By peeking at 64513 (\$FC01), you can read the byte sent by the terminal. The only problem with this is the parity bit. That is, the bytes indicating the numbers 0-9 do not increase smoothly but have bit 7 set or not to insure parity. You can solve this by

subtracting 128 when the PEEK (64513) is greater than 128. In the INCH routine this is accomplished with an AND #\$7F, masking bit 7. In this way, you get values from 48 to 57 for the keys 0-9. Now these values can be used to change the burn rate of the lunar lander.

The program is fairly short and is generally self-explanatory. The polling is done in subroutine 5000. The test for 13 is needed since this is a null byte appearing before any keyboard entry has been made. As it now runs, extra boost can be given by typing a non-numeric. This should probably be prevented since it will allow a "sinking ship" to be saved, most unsporting!!

The other interesting feature is the cursor control. This is accomplished in line 6000. The ADM-3A requires two control bytes be sent, CHR\$(27) and CHR\$(61), in order to set up the X and Y coordinates which follow. As given in the subroutine, the X value can be from 1 to 80 and the Y from 1 to 24, which correspond to the column and row (counting from the top left) of the position to be printed. Be careful when using this to not exceed these ranges. The cursor control is used to set-up a "lander control panel" and then update the "meter readings" as the play progresses.

If your wondering what line 500 does, its used for timing. By adjusting the variable DE(lay), the speed of the game can be changed slightly. I was shooting for a twice per second update on the panel. Unfortunately, when the LOW FUEL WARNING comes on the timing changes. Well, you can't have everything. (I'm sure somebody out there will figure out how to correct this....)

FE00		ORG	\$FE00
FE00 AD 00 FC	START	LDA	\$FC00
FE03 4A		LSRA	
FE04 90 FA		BCC	START
FE06 AD 01 FC		LDA	\$FC01
FE09 29 7F		ANDIM	\$7F
FE0B 48		PHA	
FE0C AD 00 FC		LDA	\$FC00
FE0F 4A		LSRA	
FE10 4A		LSRA	
FE11 90 F9		BCC	\$FE0C
FE13 68		PLA	
FE14 8D 01 FC		STA	\$FC01
FE17 60		RTS	
FE18 20 00 FE		JSR	START
FE1B C9 52		CMPIM	\$52
FE1D F0 16		BEQ	\$FE35
FE1F C9 30		CMPIM	\$30
FE21 30 F5		BMI	\$FE18
FE23 C9 3A		CMPIM	\$3A
FE25 30 0B		BMI	\$FE32
FE27 C9 41		CMPIM	\$41
FE29 30 ED		BMI	\$FE18
FE2B C9 47		CMPIM	\$47

```

100 PRINTCHR$(26):X=25:Y=10:GOSUB6000
104 PRINT"L U N A R   L A N D E R ":Y=12:GOSUB6000
106 INPUT"DO YOU NEED INSTRUCTIONS (Y/N) ";N$
110 IFN$="N"GOTO190
115 PRINT:PRINT
120 PRINTTAB(10)"THIS IS A REAL TIME LUNAR LANDER SIMULATION.
130 PRINTTAB(10)"TO PLAY, MERELY ENTER THE POUNDS OF
140 PRINTTAB(10)"FUEL WHICH YOU WISH TO BURN BY TYPING A DIGIT (0-9).
150 PRINTTAB(10)"THE NINE GIVES MAXIMUM BURN, SLOWING YOU DOWN AT THE
155 PRINTTAB(10)"FASTEST RATE. A ZERO GIVES NO BURN AND LETS YOU FRE
160 PRINTTAB(10)"FALL.":PRINT:INPUT"  READY...TYPE GO  ";N$
190 PRINTCHR$(26):Y=4:X=28:GOSUB6000:PRINT"TIME TO FUEL EXHAUSTION"
200 X=20:Y=7:GOSUB6000:PRINT"BURN RATE"
220 X=50:GOSUB6000:PRINT"FUEL"
230 Y=8:X=20:GOSUB6000:PRINT(LBS/SEC)"X=50:GOSUB6000:PRINT"(LBS)"
240 Y=12:X=20:GOSUB6000:PRINT"VELOCITY":X=50:GOSUB6000:PRINT"ALTITUDE
250 Y=13:X=20:GOSUB6000:PRINT"(FT/SEC)":X=50:GOSUB6000:PRINT" (FT)"
260 Y=18:X=20:GOSUB6000:PRINT"ESTIMATED TIME TO LANDING "
270 Y=22:X=1:GOSUB6000:FORI=1TO79:PRINT"-";:NEXTI
275 Y=23:X=1:GOSUB6000:PRINT"O  "
280 FORI=1TO7:X=10*I:GOSUB6000:PRINTI;:NEXTI
290 X=30:Y=24:GOSUB6000:PRINT"ALTITUDE (X10,000 FT.)":GOSUB6000
310 VE=-100:MT$="          ":FU=10000:AL=80000:DE=5:BU=32
320 FORT=1TO10000
330 IFT/2=ING(T/2)THENPRINTCHR$(7);
340 VE=VE+((BU-32)*25E8)/(25E8+AL*AL))
345 VE=INT(VE)
350 AL=AL+INT(VE/2)
360 IFAL<0GOTO3000
370 IFFU<500THENGOSUB2000
380 FU=FU-BU/2
385 IFFU<=0THENFU=0:BU=0
390 IFBU<=0THENB$="NO BURN":GOTO410
400 B$=STR$(INT(FU/BU))
410 X=38:Y=5:GOSUB6000:PRINTMT$:GOSUB6000:PRINTB$
420 X=21:Y=9:GOSUB6000:PRINTBU:X=50:GOSUB6000:PRINTFU
430 X=22:Y=14:GOSUB6000:PRINTVE:X=50:GOSUB6000:PRINTAL
440 IFVE>=0THENA$="ESCAPE":GOTO460
450 A$=STR$(INT(AL/ABS(VE)))
460 Y=19:X=38:GOSUB6000:PRINTMT$:GOSUB6000:PRINTA$
461 TA=INT((AL+500)/1000):IFTA>80THENTA=80
462 IFTA<1THENTA=1
463 Y=21:X=TA+1:GOSUB6000
465 IFFU=0GOTO500
470 GOSUB5000:IFZ=13GOTO500
480 BU=12+4*(Z-48)
490 IFZ=48THENBU=0
500 FORTI=1TODE:A=SIN(10):NEXTTI
505 VP=VE:AP=AL
510 NEXTT
2000 FORJ=1TO2
2005 X=36:Y=12:GOSUB6000:PRINT"LOW FUEL"
2010 Y=13:GOSUB6000:PRINT"WARNING"
2020 A=SIN(10)
2030 GOSUB6000:PRINTMT$:Y=12:GOSUB6000:PRINTMT$
2035 A=SIN(10)

```

```

2040 NEXTJ
2050 DE=I:RETURN
3000 SP=(VP+VE)/2
3010 IFSP<-25GOTO3200
3015 PRINT:PRINT
3020 PRINTTAB(20)"CONGRATULATIONS, YOU TOUCHED DOWN AT A MERE "
3030 PRINTTAB(30)SP;" FT./SEC. A SAFE LANDING !!!"
3040 PRINT:PRINTTAB(20)" DO YOU WANT TO TRY AGAIN AND"
3050 PRINTTAB(20)" ";:INPUT"PROVE IT WASN'T LUCK ";N$
3060 IFN$="N"THENRUN"BEXEC*"
3070 GOTO190
3200 PRINTCHR$(26)
3210 N=40
3220 FORI=1TON:X=1+INT(79*RND(I)):Y=1+INT(23*RND(1))
3225 GOSUB6000:PRINTCHR$(33+INT(15*RND(1))):GOSUB6000:NEXTI
3230 X=20:Y=10:GOSUB6000:PRINT"YOU JUST BLEW A CRATER,"
3240 Y=11:GOSUB6000:PRINTABS(VE);" FEET IN DIAMETER, ON THE
3250 Y=12:GOSUB6000:PRINT"SURFACE OF THE MOON. BETTER TRY AGAIN...
3260 Y=14:GOSUB6000:INPUT" READY (Y/N) ";N$
3270 GOTO190
5000 Z=PEEK(64513)
5005 IFZ=13THEN RETURN
5010 IFZ>128THENZ=Z-128:RETURN
6000 PRINTCHR$(27);CHR$(61);CHR$(Y+31);CHR$(X+31);:RETURN

```

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ASK THE DOCTOR - PART IV GOOD NEWS/BAD NEWS

Robert M. Tripp, Ph.D.
The COMPUTERIST, Inc.
P.O. Box 3
So. Chelmsford, MA 01824

In last month's issue I announced that Synertek Systems has informed me of an improvement to the SYM monitor which should solve the audio cassette sensitivity problem that I had mentioned in several columns. I have since received a copy of the new SYM-1 Supermon Version 1.1 on a pair of EPROMs (which I had supplied to them) and have had some chance to evaluate the new version. The documentation I received was in the form of a two page letter. Not having the monitor listing limited by ability to fully evaluate the changes.

The Good News

According to the letter only two minor hardware changes are required in the cassette circuit. These are similar to some reported independently by other users and reported in an earlier column. "Change C16 to .22 microfarad" and "change R97 to 1K ohm".

This list of improvements that accompanied the V1.1 monitor, along with my comments appears below. (The Synertek notes are in bold face. My comments are normal type.)

1. The **Improved High Speed Cassette** read/write is significantly better than before. I was able to write and read quite constantly and was able to produce a tape on one type of recorder and read it on another. The volume/tone range was much wider. Whereas before you had to be right on for any chance of success, now you can have a reasonable variation in volume and tone and still get a good read. This is particularly important when you are using different recorders with different characteristics. The two recorders I tested with were a Superscope C-190 and a Pioneer Centrex. These fairly high quality recorders have **not** worked reliably with the old V1.0 monitor. A suggestion I had made to Synertek back in June 1978 was to make the leader time variable. While the 8 seconds they had built-in in V1.0 is acceptable when you are only occasionally storing a program, it was much too long if you intended to use the tape service to save small chunks of data - mailing list information for example. The above note says that the leader time is now maintained in ram and can be changed by the user if necessary. Since I did not have the listing or additional information, I was not able to test this out. But, assuming it does work, this can be a very significant improvement. Some programs I have written require a lot of extra code simply to get around the "fixed" leader problem. They should be much simpler now, since I should be able to set the leader time in ram and then use the tape cassette routines directly.

2. **KIM read. Read routine improved.** This has been one of the biggest problems for the SYM-1 since its release. The V1.0 monitor had a simple, but powerful, bug. It made an invalid test for the KIM format "end-of-data" character, and treated the legal 32 46 ASCII pair as an ASCII "I", thereby terminating prematurely whenever it encountered a "2F" in the data. This made the KIM format mode of the SYM-1 essentially useless. This has been fixed in the new version. This means that it is now possible to distribute software, data bases, source files, etc. between the KIM-1, SYM-1 and AIM 65 using the common KIM format.

3. **Beeper frequency adjusted for maximum output.** I'll take their word for this. It does sound a little louder, but then I had never had any trouble with the beeper in V1.0.

4. **During the VERIFY command a BREAK key will stop printout without printing an error message.** I didn't test this minor improvement, but it is nice to keep error messages for real errors.

5. **BREAK key is looked for on current loop interface.** If you are using a teletype device, it is handy to have the BREAK key work, so this change is definitely good.

6. **Log-on changed to SY1.1.** Yes.

7. **After paper tape load the error message count is displayed.** I do not have any paper tape facility to test this, but it is a minor improvement.

8. **Ability to return to a higher level program (left arrow).** I do not quite understand what this is supposed to mean, but I am sure when additional documentation is available it will make sense.

9. **Cassette file I.D. displayed on left digit seven segments.** This is both cute and useful. They have simply taken the ID value and put it out on the leftmost digit. It does take a bit of deciphering though. The figure below shows the value of each segment on the display. These must be separately read and then added together to get the file ID. It is useful when you are searching the tape for a particular tape ID.

10. **Unwrite-protect routine added to cassette logic.** Again, I could not test this due to zero documentation.

11. **Register name improvement on display during R command.** Hooray! Now the display shows the register name, not a "hard-to-remember-and-interpret" arbitrary number to identify which register you are examining. P for program counter; S for stack; F for flags; A for A register, to represent an X for the X register; and Y for the Y register. A simple but very nice improvement.

12. **Debug-on will not cause ram to be write protected.** I did not test this, but it sounds reasonable.

That's the good news.

The Bad News

The bad news isn't all that bad, but should be considered. First, the changes to the Supermon do move some code around and change some "internal" entry points. Although the Synertek programmer I talked to said that this was not going to be very important since the main entry points were not touched, I found the first program I tried to run, the SYNC generator from the Reference Manual, would not work since two of the routines it requires have moved. How great a problem will this be? It is difficult to guess. I haven't seen the listings and do not know what routines were changed and also do not know how often other programmers have used them directly. It will be a problem for anyone who is trying to make program for distribution since there may be a requirement for two versions - one for V1.0 and another for V1.1 - and this adds to the expense and can cause distribution problems. Hopefully, the number of routines affected is small and isn't a big problem - but at present, "Who knows?".

Second, the V1.1 does use up some (most?, all?) of the Scratch Pad RAM in the System RAM. While this is not necessarily a big problem for future programs, it may cause problems for existing programs which use this previously available resource. Care will have to be taken when transferring programs from V1.0 to V1.1 to take this change in scratch pad availability into account.

Third, Synertek does not seem to have a policy yet for how the new V1.1 will be distributed. They are still waiting for feedback from myself and a couple of other users before committing to ROM, so it will be some time before any of the V1.1 are available at all. Then there is the question of systems already in the field or on dealer's shelves. Will there be a reasonable "exchange" policy, say Synertek's actual ROM production cost of \$10-\$15.00, or is some outlandish price going to be charged. I strongly feel that Synertek has the responsibility to offer the new V1.1 at the lowest price possible. Some of the changes they have made are not "cosmetic" or simple "improvements". They are basic "corrections" to their original "flawed" V1.0.

SYM-1 Codes

Ever wonder what the various codes were that the SYM used: key-code, ASCII code, and display code? You can look them up in the SYM manual in various places, but, why not let the SYM itself generate a display of these codes. The following program is an aid in establishing the relations between the three different codes. Start the program at 0000. The display goes blank, and when a key is depressed, the display will show key code, ASCII and display-scan code for a short time, and go blank again with a "beep".

Submitted by
Jan Skov
Majvaenget 7
DK-6000 Kolding
The Netherlands

SYM-1 CODE DISPLAY JAN SKOV FEBRUARY 1979

0000 ORG \$0000

SYM SUBROUTINES

0000	ACCESS *	\$8B86	SYSTEM RAM ACCESS
0000	SPACE *	\$8342	OUTPUT SPACE TO DISPLAY
0000	INCHR *	\$8A1B	INPUT CHARACTER
0000	OUTCHR *	\$8A47	OUTPUT CHARACTER
0000	OUTBYT *	\$82FA	OUTPUT BYTE
0000	SCAND *	\$8906	SCAN DISPLAY
0000	BEEP *	\$8972	

0000	20 86 8B	START	JSR	ACCESS	
0003	A2 06		LDXIM	\$06	
0005	20 42 83	LOOP	JSR	SPACE	
0008	CA		DEX		
0009	D0 FA		BNE	LOOP	
000B	20 1B 8A		JSR	INCHR	
000E	85 EF		STAZ	\$00EF	
0010	A9 2D		LDAIM	\$2D	
0012	20 47 8A		JSR	OUTCHR	
0015	A5 EF		LDAZ	\$00EF	
0017	20 FA 82		JSR	OUTBYT	
001A	AD 42 A6		LDA	\$A642	DISPLAY BUFFER
001D	20 FA 82		JSR	OUTBYT	
0020	A2 0B		LDXIM	\$0B	
0022	86 EE		STXZ	\$00EE	
0024	86 ED		STXZ	\$00ED	
0026	20 06 89	LOOPA	JSR	SCAND	DISPLAY AND
0029	C6 ED		DECZ	\$00ED	TIMER LOOP
002B	D0 F9		BNE	LOOPA	
002D	C6 EE		DECZ	\$00EE	
002F	D0 F5		BNE	LOOPA	
0031	20 72 89		JSR	BEEP	
0034	4C 00 00		JMP	START	

THE MICRO SOFTWARE CATALOG: VIII

Mike Rowe
P.O. Box 3
S. Chelmsford, MA 01824

Name: **Missile-Anti-Missile**
System: **Apple**
Memory: **16K**
Language: **Apple II Soft**
Description: Simulated missile attack on 3-D Map of USA
Copies: **30**
Price: **\$9.95 + \$1.00** postage & handling
Includes: Cassette with instructions
Author: **T. David Moteles & Neil Lipson**
Available from:
Progressive Software
P.O. Box 273
Plymouth Mtg., PA 19462

Name: **DISK DUMP/RESTORE**
System: **Apple II with disk**
Memory: **32K (min)**
Language: **Applesoft II and machine language**
Hardware: **Apple II, Disk II**
Description: A disk-tape utility to dump and restore all Integer, Applesoft II, and Binary programs automatically. The program names, Binary program addresses, and all commands necessary to re-load the programs from tape and restore them again to disk under their original names are stored on tape header file.
Copies: **Just released**
Price: **\$8.00**
Includes: Cassette and instructions
Author: **Alan G. Hill**
Available from:
Alan G. Hill
12092 Deerhorn Dr.
Cincinnati, Ohio 45240

Name: **NOT ONE**
System: **KIM**
Memory: **1K**
Language: **Assembly**
Hardware: **Bare Kim!**
NOT ONE is an exciting, fast moving game of skill, strategy, and change for one to five players (including KIM). The game is designed for use with KIM's onboard display and hex pad.
Besides being an entertainment game, the NOT ONE package was designed to introduce some powerful general-purpose output manipulation subroutines for the KIM's LED display. These include variable-speed, scrolled alpha-numerics!
The manual also discusses LED segment codes in an effort to increase the user's knowledge of the display.
Author: **Steven Wexler**
Price: **\$15.00**
Includes: Source listing, manual, and cassette
Available from:
SJW, Inc.
P.O. Box 438
Huntingdon Valley, PA. 19006

The 6502 Program Exch.
2920 Moana
Reno, NV. 89509

Name: **A Forth System**
System: **Apple II**
Memory: **24K or Larger**
Language: **40% ASSEMBLY, 60% Forth**
Hardware: **Disk II**
Description: A unique software package for software buffs and serious programmers who have gotten tired of programming in integer basic and machine language. FORTH is an extensible language, allowing the programmer to "define" new dictionary entries that use previous entries. Most of FORTH is written in FORTH. Benchmarks show that FORTH executes 20 times faster than BASIC. Included in the package are:
1) Powerful screen editor for system development.
2) Decompiler - used to generate to some extent a source listing. It can be used to list our portions of FORTH itself.
3) Utility package - dump, disk maintenance etc. does not use apple II dos.
4) Completely documented using a special disk retrieval system. includes some programming examples. Editor, decompiler is available on source.
Copies: **Just Released**
Price: **\$39.95 + tax** for california residents
Includes: One mini diskette + manual
Author: **John T. Draper**
Available from:
Captain Software
PO Box 575
San Francisco, CA 94101

Name: **Function Graphs and Transformations**
System: **Apple II**
Memory: **16K minimum if Applesoft is in ROM, otherwise 32K minimum**
Language: **Applesoft (floating point Basic)**
Hardware: **No special hardware**
Description: This program uses the Apple II high resolution graphics capabilities to draw detailed graphs of mathematical functions which the user defines in Basic syntax. The graphs appear in a large rectangle whose edges are X and Y scales (with values labeled by up to 6 digits). Graphs can be superimposed, erased, drawn as dashed (rather than solid) curves, and transformed. The transformations available are reflection about an axis, stretching or compressing (change of scale), and sliding (translation). The user can alternate between the graphic display and a text display which lists the available commands and the more recent interactions between user and program. Expected users are engineers, mathematicians, and researchers in the natural and social sciences; in addition, teachers and students can use the program to approach topics in (for example) algebra, trigonometry, and analytic geometry in a visual, intuitive, and experimental way which complements the traditional, primarily symbolic orientation.
Copies: **Just released**
Price: **\$14.95** (Cat. No.: AHE0123)
Includes: cassette tape, 12-page instruction booklet
Author: **Don Stone**
Available from: many computer stores or
Powersoft, Inc.
P.O. Box 157
Pitman, NJ 08071
(609) 589-5500

Name: **6502 VDR**

Systems: Any 6502 with room available at \$200 or \$DD00

Memory: 1/4 K

Language: **6502 machine code**

Hardware: **Memory-mapped video board such as Polymorphic Systems VTI, Solid State Music VB-1B, Etc.**

Description: Organizes memory-mapped display for teletype-like use including automatic scrolling, line wrap-around, clear screen commands, etc.

Copies: **30**

Price: **\$9.50 plus \$1 shipping**

Includes: Operating Manual, detailed configuration information, and complete commented source listing.

Order: Package includes KIM compatible tape cassette with both \$200 and \$DD00 versions included. Charge cards, phone and mail order accepted.

Available from:

Forethought Products
97070 Dukhobar #D
Eugene, Oregon 97402

Name: **CHEQUE—CHECK™**

System: **PET**

Memory: **8K**

Language: **BASIC, with machine language subroutine**

Hardware: **PET 2001-8 (or 2001-16/32 on special order)**

Description: CHEQUE-CHECK reduces the probability of error in reconciling bank statement and checkbook, even for those experienced in the art. More important it greatly reduces the time required to find and correct an error when one does occur, because it "remembers" individual entries for later review and modification if necessary. Designed and tested for ease of use, CHEQUE-CHECK is suitable for novice or expert, and requires no tape files or knowledge of programming. Reviewed in May 1979 issue of Robert Purser's Reference List of Computer Cassettes.

Copies: **60 sold** in first three months.

Price: **\$7.95** (quantity discount available)

Includes: Cassette in Norelco style box, Description and operating instructions, zip-lock protective package.

Designer: **Roy Busdiecker**

Available from: Better computer stores or directly from

Micro Software Systems
P.O. Box 1442
Woodbridge, VA 22193

Name: **Disk Catalog Program**

System: **Apple II**

Memory: **32 K minimum**

Language: **Integer Basic and Machine Language**

Hardware: **Apple II, DISK II**

Description: This program consists of two modules. The first, DCATPRO, is a general purpose data base catalog program for books, records, tapes, programs on diskette, etc. Features include 40 col. records, 5 fields (2 with adjustable length), and super fast machine language sort. The second, GENCPINP, automatically processes any set of Apple II diskettes and generates a data base for DCATPRO by reading the D\$CATALOG information for each diskette. Then you know what you have and **where it is**, all without having to type in a lot of data.

Copies: **Over 100 sold**

Price: **\$10.00 postpaid**

Includes: Programs on cassette and 5 pages of documentation

Arthur: **George W. Lee**

Available from:

George W. Lee
18003 S. Christina Ave.
Cerritos, California 90701

Name: **Generalized File Management**

System: **APPLE II**

Memory: **16K**

Language: **Integer Basic**

Hardware: **APPLE II, DISK II**

Description: This package allows you to create, update, and print disk files. The names of fields and files, number of fields, individual field lengths, and file size is user defined. You can decide what headings you want to see (if any) when you print or display and record or the entire file. You can use this package to create such files as: Parts lists, phonenos., List of birthdates, name and address, and whatever...

Copies: **Just released**

Price: **\$16.50**

Includes: Diskette that contains two programs, some sample file usages (birthdates, parts list), and a user manual.

Author: **Lee Stubbs**

Available from:

Les Stubbs
23725 Oakheath Pl. Harbor City, Ca 90710

Name: **WEAVER**

System: **Apple II**

Memory: **32K**

Language: **Integer Basic**

Hardware: **Disk II**

Description: WEAVER simulates as multi-harness loom with control of warping, hook-up and treadling. Weaving drafts of 40 threads of warp and 40 threads of weft are drawn in 15 colors for patterns requiring up to 24 harnesses. Weaving patterns are saved and called by name from disk storage. The user-interface is designed for easy and efficient use by a weaver. Nine pages of documentation include a glossary of commands which defines the functions of the program and a sample draft with descriptive data entry.

Copies: **New program.**

Price: **\$15.00** on cassette tape, **\$20.00** on diskette with five sample drafts.

Author: **Bruce Bohannon**

Available from:

Bruce Bohannon
2212 Pine Street
Boulder, CO 80302

Name: **Address and Perpetual Calendar**

System: **APPLE II**

Memory: **32K**

Language: **Applesoft II**

Hardware: **APPLE II w/Disk II**

Description: This program maintains your master address file on disk. User follows a master menu to add or change names, look for specific names or review entire file (or part) name by name. All outputs are formatted. Look and change records with a search function i.e., If you do not remember how to spell a name then enter the number of letters you do know and the program will walk you through all names beginning with what you entered until you find the one you want. A birthday function is included that will search your entire file and list all names, birthday and age for any given month. A special feature loads up a Perpetual Calendar program that will display any month (formatted) between the years 1704 and 2099 and highlights any particular day. Return to address program is optional.

Copies: **Just released.**

Price: **15.00 ppd**

Includes: Disk and instructions

Author: **Edward S. Kleitches**

Available from:

Edward S. Kleitches
7207 Camino Grove
San Antonio, Texas 78227

INSIDE THE KIM TTY SERVICE

Ben Doutre
621 Doyle Road
Mont St-Hilaire, Quebec
Canada J34 1M3

The fact the KIM's serial TTY port, plain and unmodified, will operate comfortably at 9600 bauds does not seem to be widely known. I, for one, went the parallel interface route as soon as I acquired a higher speed terminal, and I suspect that many others may have done likewise. After all, what can one expect of an interface described in the User's Manual in these terms: "You are not restricted to units with specific bit rates (10 CPS for TTY) since the KIM-1 system automatically adjusts for a wide variety of data rates (10 CPS, 15 CPS, 30CPS, ETC.): "That's pretty wide, alright, from 10 to etc. Other writers have been equally vague. Gary Tater in MICRO 9:14, "A Fast Talking TIM" mentions that "KIM can adapt to terminal frequencies up to 2400 baud...". This was the last straw, and I either had to pull the plug on my "Fast Talking KIM", or attempt to put the record straight.

First off, let me say that according to my interpretation of what goes on in KIM, the theoretical maximum baud rate of the TTY port is 15,625. How's that for pinning down the etc? Not that you should try to operate at this rate without some of the well-known "fine tuning", but there is no reason why you can't hook up your 9600 or 4800 baud terminal, with 30 cents worth of gates, and be up and running, with or without reading the following details. If you want to know from whence this bonanza, here is the story.

The smarts for the KIM TTY interface are in the monitor software, so let's start at that end. There are two main TTY I/O routines: GETCH at 1E5A and OUTCH at 1EA0. GETCH returns with the character in A but strips off the parity bit in the process. If you need bit 7 (counting from 0) for your own deep, dark reasons, then retrieve the full character from CHAR at 00FE on your return. OUTCH (love that label!) outputs a stop bit, then a start bit, then 8 data bits (LSB first), then another stop bit. It may seem illogical to start with a stop, but remember that, aside from slow machinery, the main purpose of a stop bit (line high) is to make sure that the start bit (line low) will be recognized. In any case, the stop interval is 2 bits long plus the delay between calls to OUTCH.

Both GETCH and OUTCH are timed by subroutine DELAY at 1ED4. (GETCH also used DEHALF to move its strobe to the mid-point of a bit interval, but let's not get technical.) DELAY does its thing based on the contents of a 16-bit counter named, for some obscure reason, CNTH30 (high byte, at 17F3) and CNTH30 (low byte, 17F2). If this counter is equal to 0000 or less, DELAY falls through all the way, with a resulting minimum bit time of 64us. (Let's assume your crystal is bang-on 1 MHz.) Presto: divide 64us into a million, and you come up with 15,625 baud.

Not convinced? OK, here's more. Every time we add one to the counter, DELAY adds another 14 us to its timing loop. The high end of the baud scale looks like this:

Counter	Bit Time (us)	Baud Rate
0000	64	15,625
0001	78	12,820
0002	92	10,869
0003	106	9,434
0004	120	8,333

If we turn this around and start with some of the usual standard baud rates, we can calculate the bit times and counter values required. For instance, 9600 bauds obviously needs something between 2 and 3. DELAY doesn't do fractions - it doesn't even like odd numbers. And how does the counter get properly loaded anyway?

We've left the best to the last, a little jewel called DETCPS at 1C2A. DETCPS is entered following a system reset with TTY enabled. Its brief hour of glory is in measuring the duration of the start pulse of the first character you feed in after a Reset. It quickly stuffs the results in the 16-bit counter, then goes out for coffee until the next Reset. The question is: will DETCPS buy 9600 bauds? The answer is YES, albeit a little reluctantly. The thing is the DETCPS is sampling the input port, waiting for the line to go low - it checks for this every 9 us, so it could miss your start pulse start by this much. Once the line is low, it squirrels away 14 us counts, checking for line high every 14 us. So it could miss the end of your start pulse by 14 us.

At 10, 15, 30 or etc CPS, this sloppiness is probably acceptable. With a Model 33 on the line, DETCPS gaily reports 02C2 plus/minus OB, for instance. But if it comes up with 0004 instead of 0003 at 9600 bauds, your TV screen will give you a reasonable facsimile of a Chinese fortune cookie slip. Just look at it as another Butterfield game - Reset-Delete-Reset-Delete-Reset-Delete BINGO! Anyway, how many times a day do you Reset? Once you get that 3, your link with KIM will be rock solid.

There are a number of fascinating details, but I will spare you the pyrotechnics. If all this is on the leve, I should be able to prove it, right? Well, I have an ESAT-100 (RHS Marketing) video board equipped with an AY3-1015 UART hooked up to the KIM TTY port. The manual admits to a -1% to DETCPS. I set the speed selector switch to each of the 6 rates available, did 10 resets at each and recorded the counts. (A clever piece of programming, at that!) Except for 9600, all resets were OK the first time around. The counts did not vary, except for 300 baud. The results look like this:

Baud Rate	Bit Time (us)	Calc. Count	Meas'd Count
9600	104.2	0003	0003
4800	208.3	000A	000B
2400	416.7	0019	001A
1200	833.3	0037	0038
600	1666.7	0072	0074
300	3333.3	00EA	00EC/00ED

A few further words of explanation for the fellow who may be hung up because he has been spared intimate relations with "real" TTY machines. (You experts can go figure out an algorithm or two - try infinite recursion on "Every rule has an exception, except this one.")

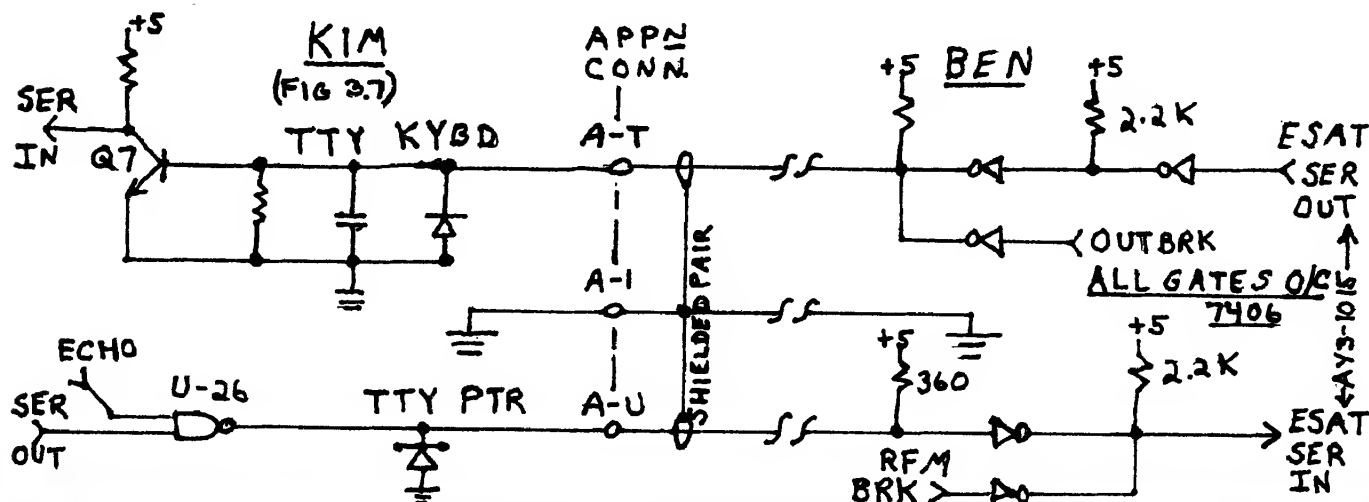
Referring to the KIM-1 User's Manual, Fig. 3.7, you will see two KYBD lines and two PTR lines. The action at the other end of these lines is assumed to be as follows: - During idle conditions, the keyboard lines are shorted out, generating a continuous high at the input to Q7; the printer lines are connected to a "selector magnet" (quaint) or a relay which is drawing a nominal 20 mA. -when the keyboard is sending characters, the KYBD lines are open-circuited for zero bits and shorted for one bits. When KIM sends characters on the PTR lines, it opens the circuit for zero bits by floating the output of O/C gate U26 (7438), and closes the circuit for one bits by pulling U26 to ground. Incidentally, this 7438 can sink up to 48 mA.

If you want to simulate this hardware with some other device, you need to feed the line labelled "TTY KYBD" with positive logic signals (low for ones, open for zeros) from the line labelled "TTY

PTR". You should note that the keyboard line has a 220-ohm pull down resistor on it, and that the printer line has no pull-up.

You may also notice, if your terminal has a FDX/HDX selector switch or jumper, that the FDX no longer works as advertised. This is just KIM trying to be helpful, with a wired-in interconnect which echos received characters on the output line. If this keeps you awake at night, cut the trace between pin 11 and U15 and pin 10 of U26, and connect pin 10 of U26 to Vcc. (I haven't tried it, but it should work. I'm a sound sleeper.)

If you need a for-example, I show a diagram of my own interface logic, based on a 7406 gate package, which is working quite satisfactorily. There are probably 1000 other ways of doing it, each one of which can be improved by SuperSilicon. If it works and doesn't smoke, have at it.



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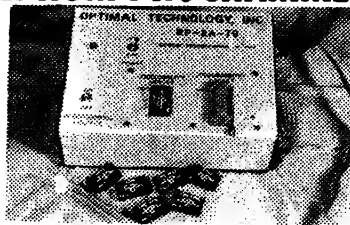
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THE INTEGER BASIC TOKEN SYSTEM IN THE APPLE II

Frank D. Kirschner
2643 Rockledge Trail
Dayton, OH 45430

There are two primary methods of storing BASIC programs in microcomputers. One involves storing the entire program, letter by letter and symbol by symbol somewhere in memory, and interpreting the ASCII codes on execution. This is typical of BASIC compilers and some interpreters, like the TRS-80 Level 1. A more memory-efficient system uses tokens, eight bit bytes each of which represent a BASIC word or symbol. The TRS-80 Level II uses this method, as does the Apple II, to which the examples which follow apply.

When in Integer BASIC, the Apple stores characters as they are entered in a character buffer (hex locations 0200 to 02FF). When "return" is entered, BASIC "parses" the entry (that is, interprets the ASCII characters and breaks the instruction into executable parts). It determines what is a command, what are variables, data and so forth. If it is legal and is preceded by a number between 0 and 32767 (a line number), it stores it in memory in a fashion discussed below. If there is no line number, it simply executes the command and awaits further instructions.

The way the programs are stored is quite clever. When BASIC is initiated (control B or E000 C from the monitor) several things happen. First, the highest available user memory (RAM) is stored in memory locations 004C (Lo byte) and 004D (Hi byte), called the HIMEM pointer. Also, locations 00CA and 00CB, the start-of-program pointer, get the same numbers, since there is no program as yet. As program steps are entered, they are stored starting at the top of memory, highest line numbers first, and the start-of-program pointer is decreased accordingly. See Figure 1. When a line with a higher number than some already in memory is entered, they are shuffled to preserve the order. One application: if you enter a program and then hit control B, the program is **not** scratched (or erased); only the start-of-program pointer is affected. Since powering up the Apple fills the memory with a pattern of ones and zeros (it looks like FF FF 00 00 ...) from the monitor, it is easy to find the start of the program and then manually reset CA and CB to that location.

This is the way program instructions are stored in memory: (All numbers are in hex)

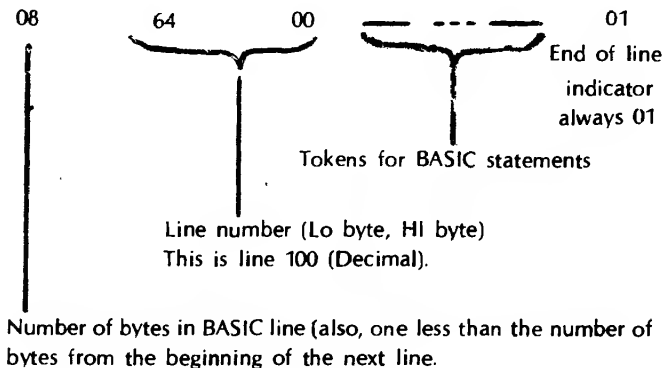


Figure 2

As an example, power up the Apple, bring up BASIC, and enter
100:PRINT 0,50

Enter the monitor (by pushing "reset"), and then examine the program by entering

EXAMPLES FOR
16K Apple

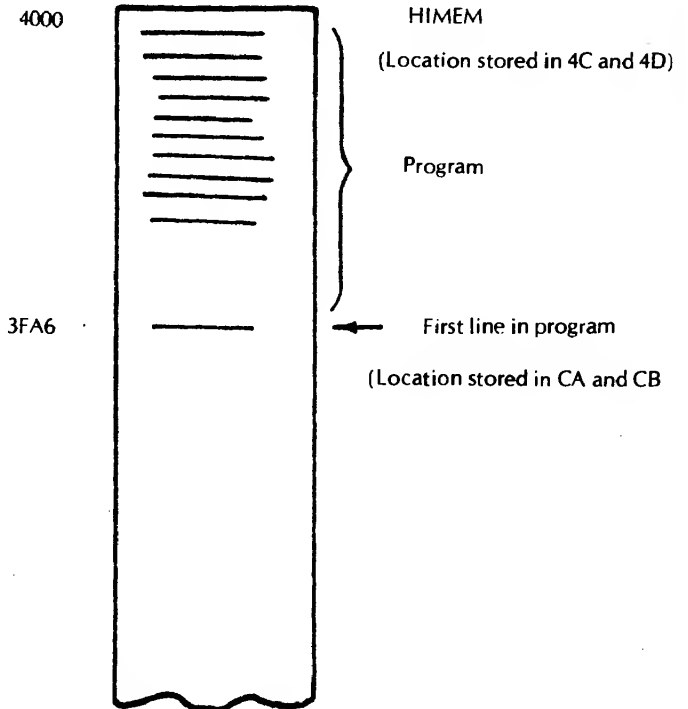


Figure 1

Memory Map for Program Storage

3FF4.3FFF return
(Locations for a 16K Apple. Subtract 2000 hex for a 4K or add 4000 hex for a 32K Apple.) You will see this:
3FF4 - 0C 64 00 62
3FF8 - B0 00 00 49 B5 32 00 01

which means:

- 0C**: There are 12 bytes in this line
- 64 00**: It is line 100 (Decimal)
- 62**: PRINT (see Table 1 for complete list of tokens)
- B0**: The next two bytes are a number (rather than tokens)
- 00 00**: The number 0
- 49**: The comma in a PRINT statement
- B5**: Another number follows
- 32 00**: The number 50
- 01**: End of BASIC line

To demonstrate the use of this information, return to BASIC and try to enter the following BASIC line:

100 DEL 0,50

You will get a syntax error, because the Apple Interpreter does not allow the command DEL in deferred execution mode. Now do this: reenter the monitor and change the 62 (PRINT) to 09 (DEL) and the 49 (,for PRINT) to 0A (, for DEL) by entering

3FF7: 09 Return

3FFB: 0A Return

Reenter BASIC (control C) and list. Try this instruction by adding lines between 0 and 50, running the program, and then listing it. This allows you to write a program which will carry out some functions only the first time it is run and then automatically delete those lines.

In addition to inserting instructions which cannot be entered as deferred commands, you can modify the program under program control. As an example, here is a program which will stop and start listing a long program by hitting a key on the keyboard.

Bring up BASIC.

Enter: 257 LIST 0: RETURN

HIT RESET, 3FF6.3FFF RETURN

You will see

3FF6 - 0A 01

3FF8 - 01 74 B0 00 00 03 5B 01

What this means:

3FF6: 0A Ten bytes in line

3FF7,8: 01 01 LINE 257

3FF9: 74 TOKEN FOR LIST

3FFA: B0 Means "Number follows"

3FFB,C: 00 00 LINE TO BE "LISTED" (LO, HI)

3FFD: 03 TOKEN FOR COLON

3FFF: 01 End of BASIC LINE

Now enter 3FF7: FF FF Return

Cont. C, List

You have 65535 LIST 0: RETURN

Now enter

100 X=PEEK (-16384): POKE -16368, 0:1F

X 127 THEN 0: GOTO 100

Reset, 3FCF.3FFF Return

Change line no. from 100 to 65534 by entering 3FDO: FE FF Return

Change GOTO 100 to GOTO 65534 by entering 3FF3: FE FF

Change the 0 in "THEN 0" to 65533 by entering 3FEE: FD FF
In like manner, enter these remaining steps: (Under each number which has to be entered through the monitor, the Hex equivalent, in reverse order as it must be entered, appears)

65533 1 = 1 PEEK (1): IF1> PEEK (76)*

(FD FF)

256*PEEK (77) THEN END: GOTO

65531

(FB FF)

65532 X=PEEK (-16384):POKE -16386,0:

(FC FF)

IF X 127 THEN 65534

(FE FF)

65531 POKE 16374, PEEK (1+1): POKE 16380

(FB BB)

PEEK (1+2): GOSUB 65535

(FF FF)

32767 1=PEEK (202) 256* PEEK (203)

The steps must be entered in reverse order (i.e descending line numbers) because the interpreter orders them by their number when entered, and will not re-order lines when the numbers have been changed through the monitor.

The reason for making all these line numbers very high is so the applications program will fit "under" the list program.

Now, in the monitor, move the start of program and HIMEM pointers below the program:

3A: 49 3F Return

4C: 49 3F Return

Hit control C and list. Nothing is listed. The program has been stored in a portion of memory temporarily inaccessible to BASIC. Load your applications program, make sure all the line numbers are less than 32767, and change HIMEM through the monitor (4C: 00 40) and execute RUN 32767. The program will list until you hit a key and then resume when you hit a key again. It uses the fact that each line begins with the number of bytes in the line followed by the line number. Numbers of successive lines are found and "POKE into the appropriate location in line 75535, which then lists each line.

Using these methods you can exercise considerably more control over the BASIC interpreter in your microcomputer.

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TABLE I

APPLE II INTEGER BASIC TOKENS

BASIC COMMAND OR FUNCTION	HEX TOKEN		BASIC COMMAND (CONT)	HEX TOKEN
ABS	31		LOAD	04
{	3F		MAN	0F
}	72		NEW	0B
ASC (	3C	Includes left paren.	NEXT	59
)	72			5A
"	28	first quote	NO DSP	79
"	29	second quote	NO TRACE	7A
AUTO	0D		PDL	32
,	0A		(	3F
CALL	4D		)	72
CLR	0C		PEEK	2E
COLOR=	66	Includes =	3F	(
CON	60		72)
DEL	09		PLOT	67
,	0A			68
DIM	4F	Numeric Arrays	POKE	64
(	34		,	65
)	72		POP	77
DIM	4E	String Array	PRINT	63 If used alone
(	22		PRINT	62 Numeric Variable
)	72		:	46
\$	40		,	49
DSP	7C	Numeric Variable	PRINT	61 String Variable
DSP	7B	String Variable	"	28 First
END	51		"	29 Second
FOR	55		PR #	7E Includes #
=	56		REM	5D
TO	57		RETURN	5B
STEP	58		RND	2F
GOSUB	5C		(	3F
GOTO	5F		)	72
GR	4C		-	36
HIMEN:	10	Includes :	SAVE	05
HLIN	69		SCRN (	3D Includes (
	6A		,	3E
AT	6B		)	72
IF	60		SGN	30
THEN	24	When followed by a line no.	(	3F
THEN	25	When followed by GOSUB or a basic operation	)	72
INPUT	54	Numeric Variable	TAB	50
INPUT	52	String Variable	TEXT	4B
INPUT	53	Input if followed by ...	TRACE	7D
,	27		VLIN	6C
"	28	first	,	6D
"	29	Second	AT	6E
IN #	7F	Includes #	VTAB	6F
LEN (	3B	Includes (	:	03
LET	5E		=	71 In assignment
LIST	74		AND	1D
	75		OR	1F
			MOD	1F
			NOR	DE

PROGRAMMING THE 6502
by Rodney Zaks

Reviewed by
John D. Hirsch
Berme Road
Kerhonkson, NY 12446

In the introduction to this book the author tells us it can be used by a person who has never programmed before. Chapter one does begin with a clear presentation of some basic techniques, such as binary arithmetic. But the quality of the book rapidly degenerates in succeeding chapters, which read as though they had been assembled from manufacturer's literature and other sources, with more help from a paste-pot than a pencil.

The quality of the writing is technical-manualese and the illustrations have the same mechanistic flavor. Also the illustrations and writing are sometimes only tenuously related. A novice programmer would probably give up along about Chapter 3, when assembly language routines are introduced even though assembly language is not explained until near the end of the book. The organization of the book has a certain random quality. For instance, integer addition, subtraction and multiplication are explained in some detail in the chapter on basic programming techniques, and then division is relegated to one paragraph while the chapter goes on to a very general explanation of subroutines. The experienced programmer will not find the book very helpful either. A good chunk of the book is taken up by reprinting 6502 instructions, one per page, and potentially valuable chapters—such as the one covering 65xx interfacing chips—are very perfunctory. Dr. Zaks has the annoying habit of constantly referring the reader to manufacturer's data sheets for more details.

Chapter 9, covering data structures, is particularly puzzling. It covers data structures in a general way, with practically no information on how they can be implemented in 6502 assembly language. Perhaps the author intended this chapter for one of his other introductory computer books and pasted it in this one by mistake.

The publisher of this book has produced a good many other books which were either authored or co-authored by Dr. Zaks, all in a remarkably short time. Reading this book, it's easy to see how the trick is done.

The 6500 family software manual and Caxton C. Foster's charming introductory work PROGRAMMING A MICROCOMPUTER: 6502 (Addison-Wesley) are still the best texts for learning to program in 6502 machine or assembly language.

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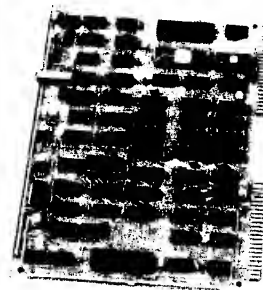
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RENUMBER APPLESOFT

Chuck Carpenter
2228 Montclair Place
Carrollton, TX 75006

Renumbering Applesoft programs suddenly became possible. The resequence program in Jim Butterfield's "Inside Pet BASIC," (MICRO 8:39) solved the problem.

After clearing up a minor problem in the program (with help from Jim) I tried it on a 200 line program. Because of the way I started numbering in the first place, I had to fix-up about a dozen lines. But, I never would have gotten through that much renumbering otherwise.

As Jim mentioned in his letter to me, a machine language program would have ran a whole bunch faster. With DOS and having to find a place to locate such a program, the BASIC approach may be easier.

Here are some comments on the Applesoft version shown in Listing 1:

- Line 60005 has some prompting inputs to set-up the program.
- Use RUN 60005 to start renumbering.
- Line 60060 branches to a DElete line.
- Line 60160 is changed to a point to the line no. in Applesoft (2049 or \$801).

Note: These are the pointers for Applesoft ROM

- Line 60160 was also changed to allow starting at any line number (M=LN-IN).
- Line 60170 changed to allow any numbering increment (M=M+IN).

```
*
*3A5L
```

03A5-	A5 67	LDA	#67
03A7-	85 06	STA	#06
03A9-	A5 68	LDA	#68
03AB-	85 07	STA	#07
03AD-	38	SEC	
03AE-	A5 69	LDA	#69
03B0-	E9 03	SBC	##03
03B2-	85 67	STA	#67
03B4-	A5 6A	LDA	#6A
03B6-	E9 00	SBC	##00
03B8-	85 68	STA	#68
03BA-	60	RTS	
03BB-	A5 06	LDA	#06
03BD-	85 67	STA	#67
03BF-	A5 07	LDA	#07
03C1-	85 68	STA	#68
03C3-	20 F2 D4	JSR	#D4F2
03C6-	60	RTS	
03C7-	FF	???	
03C8-	FF	???	

*

Listing 2

Applesoft append program. This program can be used to append any two programs together.

-Line 60220 - tokens changed for Applesoft (this information is in the Applesoft II manual).

-Line 60260 and 60270 added to delete the renumber program and end it.

To make using the program easier, an append program (also for ROM) does the job. The assembly language program shown in listing 2 links the two programs together. You only need to do this if you want to renumber an existing program. (You can still load the renumber program before you start a new program.) Here's how you use it.

-Load the append program first. It fits in page 3 starting at \$3A5.

-Load the lower line no. Applesoft program.

-Type Call 933 and (return).

-Load the higher line no. renumber program.

-Type CALL 955 and (return).

-Use RUN 60005 to start renumbering.

Be sure to record any output that appears on the screen. Write down the information and check the renumbering on the lines indicated. Putting longer line numbers in short spaces will be one message. Another will ask you to check where you used a THEN for a GOTO. The renumber program is not sure if it should renumber a line or a parameter.

My thanks to Jim Butterfield for providing us with such a useful program (and helping me get this one running). Also, thanks to Bob Matzinger from the Dallas Area Apple Corps for some modification suggestions and the Applesoft ROM append routine.

LIST

```

60000 END
60005 HOME : PRINT : PRINT "RENUMBER:" : PRINT : I
INPUT "FIRST LINE # - ";LN: PRINT : INPUT "INCREMEN
T - ";IN
60010 LET T = 0: DIM V%(100),W%(100): GOSUB 60160
: FOR R = 1 TO 1E3: GOSUB 60210
60020 IF G THEN GOSUB 60090: NEXT R
60030 GOSUB 60160: FOR R = 1 TO 1E3: N = INT (M /
256): POKE A - 1,M - N * 256
60040 POKE A,N:V = L: GOSUB 60070:W%(J) = M: GOSU
B 60170: IF G THEN NEXT R
60050 GOSUB 60160: FOR R = 1 TO 1E3: GOSUB 60210:
IF G THEN GOSUB 60110: NEXT R
60060 PRINT "*END*": GOTO 60260
60070 LET J = 0: IF T < > 0 THEN FOR J = 1 TO T
: IF V%(J) < > V THEN NEXT J:J = 0
60080 RETURN
60090 IF V < > 0 THEN GOSUB 60070: IF J = 0 THE
N T = T + 1:V%(T) = V
60100 RETURN
60110 GOSUB 60070: IF J = 0 THEN RETURN
60120 W = W%(J): IF W = 0 THEN PRINT "GO";"L";L:"
?": RETURN
60130 FOR D = A TO B + 1 STEP - 1:X = INT (W /
10):Y = W - 10 * X + 48: IF W = 0 THEN Y = 32
60140 POKE D,Y:W = X: NEXT D: IF W = 0 THEN RETU
RN
60150 PRINT "INSERT";W%(J);"L";L: RETURN
60160 LET F = 2049:M = LN - IN
60170 LET A = F:M = M + IN
60180 LET F = PEEK (A) + PEEK (A + 1) * 256:L =
PEEK (A + 2) + PEEK (A + 3) * 256:A = A + 3:G =
L < 6E4
60190 RETURN
60200 LET S = 0
60210 LET V = 0:A = A + 1:B = A:C = PEEK (A): IF
C = 0 THEN GOSUB 60170: ON G + 2 GOTO 60210,6019
0
60220 IF C < > 171 AND C < > 176 AND C < > 196
AND C < > S GOTO 60200
60230 LET A = A + 1:C = PEEK (A) - 48: IF C = -
16 GOTO 60230
60240 IF C > = 0 AND C < 9 THEN V = V * 10 + C:
GOTO 60230
60250 LET S = 44:A = A - 1: RETURN
60260 DEL 60000,60270
60270 END

```

Listing 1

]

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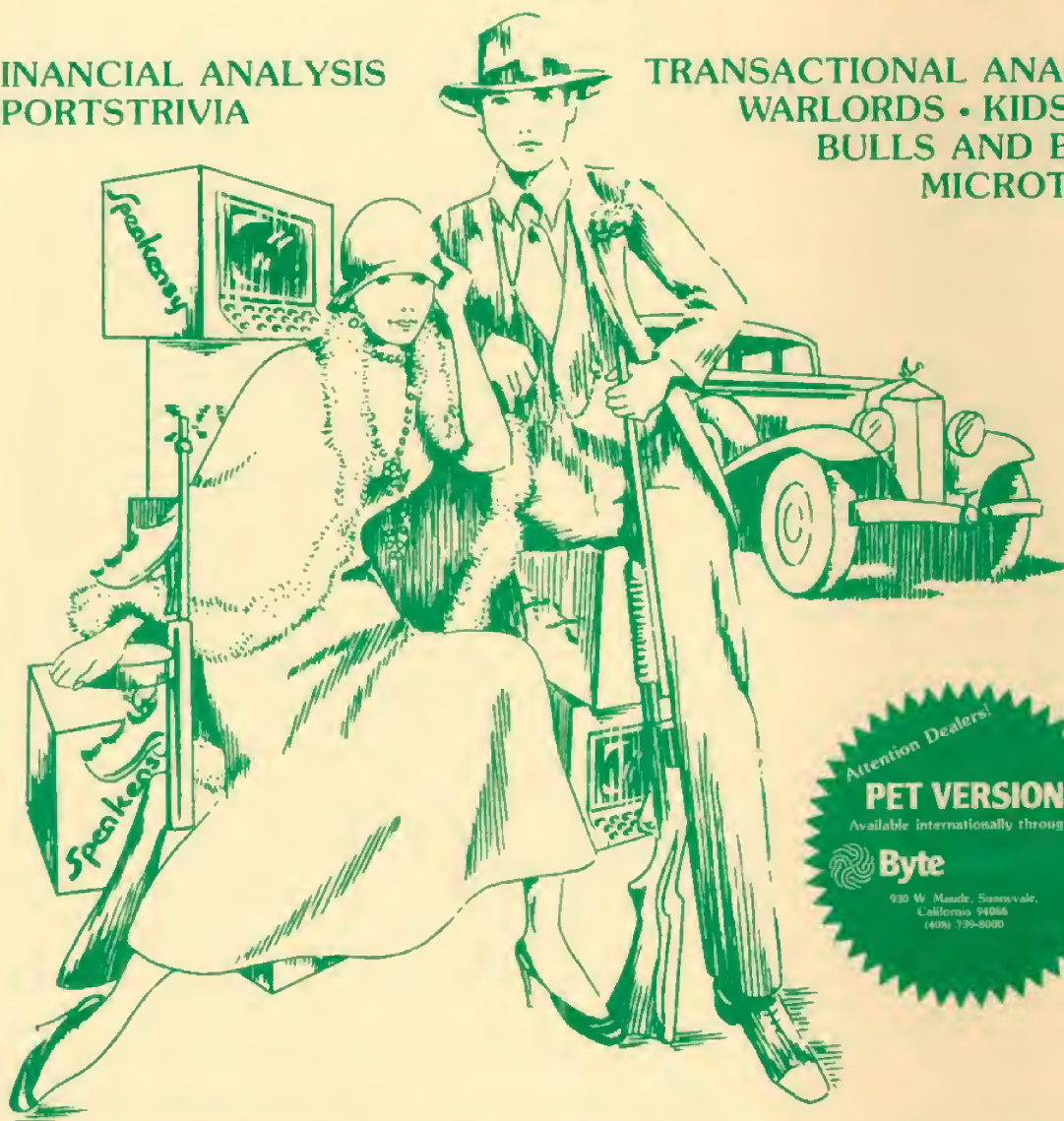
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